Storm Water Management Plan
For Priority Projects
(Major SWMP)

The Major Stormwater Management Plan (Major SWMP) must be completed in its entirety and accompany applications to the County for a permit or approval associated with certain types of development projects. To determine whether your project is required to submit a Major or Minor SWMP, please reference the County's Stormwater Intake Form for Development Projects.

Project Name:	PEPPER VILLA DRIVE
Permit Number (Land Development Projects):	
Work Authorization Number (**CIP only**):	
Applicant:	Ryan and Sara Cacy.
Applicant's Address:	8137 Winter Gardens Blvd. Lakeside CA. 92040
Plan Prepare By (*Leave blank if same as applicant*):	K&S Engineering INC. 7801 Mission Center Court Suite 100. San Diego CA. 92108 (619) 296-5565
Date:	07-15-08
Revision Date (If applicable):	

The County of San Diego Watershed Protection, Storm Water Management, and Discharge Control Ordinance (WPO) (Ordinance No. 9424) requires all applications for a permit or approval associated with a Land Disturbance Activity to be accompanied by a Storm Water Management Plan (SWMP) (section 67.806.b). The purpose of the SWMP is to describe how the project will minimize the short and long-term impacts on receiving water quality. Projects that meet the criteria for a priority development project are required to prepare a Major SWMP.

Since the SWMP is a living document, revisions may be necessary during various stages of approval by the County. Please provide the approval information requested below.

Project Stages	Does the SWMP need revisions?		If YES, Provide Revision Date
	YES	NO	
One Stage		✔	

Instructions for a Major SWMP can be downloaded at http://www.co.san-diego.ca.us/dpw/stormwater/susmp.html.

Completion of the following checklists and attachments will fulfill the requirements of a Major SWMP for the project listed above.

PROJECT DESCRIPTION

Please provide a brief description of the project in the following box. Please include:

- Project Location
- Project Description
- Physical Features (Topography)
- Surrounding Land Use
- Proposed Project Land Use
- Location of dry weather flows (year-round flows in streams, or creeks) within project limits, if applicable.

The 1.92 acre subdivision is located at Pepper Drive and Pepper Villa Drive. See attachment "A" for more detailed project description.

The project area is characterized by rolling grassy hills and shrubs, with approximately 5% of slope. An existing old house and accessory buildings 5,915 SF.(0.135AC) and pool will be demolished, and the rest of the area is undeveloped.

The Pepper Villa project is located in the San Diego River watershed and in the Lower San Diego hydrologic unit, sub-area El Cajon (907.13). The project drains south westerly towards the San Diego River. The storm drain system for this project will tie into an existing storm drain inlet. This inlet discharges directly into the storm drain system, and eventually gets to the San Diego River. Overall, the project area represents 0.0007 percent of the watershed. (281,600AC Basin area, 1.92 AC. Project area=0.0007AC.).

The proposed project will not alter the overall drainage pattern at the drainage system in Pepper Dr.

PRIORITY DEVELOPMENT PROJECT DETERMINATION

Please check the box that best describes the project. Does the project meet one of the following criteria?

Table 1

PRIORITY DEVELOPMENT PROJECT	YES	NO
Redevelopment that creates or adds at least 5,000 net square feet of additional impervious surface area	✔	
Residential development of more than 10 units	✔	
Commercial developments with a land area for development of greater than 1 acre		✔
Heavy industrial development with a land area for development of greater than 1 acre		✔
Automotive repair shop(s)		✔
Restaurants, where the land area for development is greater than 5,000 square feet		✔
Hillside development, in an area with known erosive soil conditions, where there will be grading on any natural slope that is twenty-five percent or greater, if the development creates 5,000 square feet or more of impervious surface		✔
Environmentally Sensitive Areas (ESA): All development located within or directly adjacent to or discharging directly to an ESA (where discharges from the development or redevelopment will enter receiving waters within the ESA), which either creates 2,500 square feet of impervious surface on a proposed project site or increases the area of imperviousness of a proposed project site to 10% or more of its naturally occurring condition. "Directly adjacent" means situated within 200 feet of the ESA. "Discharging directly to" means outflow from a drainage conveyance system that is composed entirely of flows from the subject development or redevelopment site, and not commingled with flows from adjacent lands.		✔
Parking Lots 5,000 square feet or more or with 15 parking spaces or more and potentially exposed to urban runoff		✔
Streets, roads, highways, and freeways which would create a new paved surface that is 5,000 square feet or greater	✔	
Retail Gasoline Outlets (RGO) that meet the following criteria: (a) 5,000 square feet or more or (b) a projected Average Daily Traffic (ADT) of 100 or more vehicles per day.		✔

Limited Exclusion: Trenching and resurfacing work associated with utility projects are not considered Priority Development Projects. Parking lots, buildings and other structures associated with utility projects are subject to the WPO requirements if one or more of the criteria above are met.

If you answered **NO** to all the questions, then **STOP**. Please complete a Minor SWMP for your project.
If you answered **YES** to any of the questions, please continue.

HYDROMODIFICATION DETERMINATION

The following questions provide a guide to collecting information relevant to hydromodification management issues.

Table 2

	QUESTIONS	YES	NO	Information
1.	Will the proposed project disturb 50 or more acres of land? (Including all phases of development)		✔	If YES, continue to 2. If NO, go to 6.
2.	Would the project site discharge directly into channels that are concrete-lined or significantly hardened such as with rip-rap, sackcrete, etc, downstream to their outfall into bays or the ocean?		✔	If NO, continue to 3. If YES, go to 6.
3.	Would the project site discharge directly into underground storm drains discharging directly to bays or the ocean?		✔	If NO, continue to 4. If YES, go to 6.
4.	Would the project site discharge directly to a channel (lined or un-lined) and the combined impervious surfaces downstream from the project site to discharge at the ocean or bay are 70% or greater?	✔		If NO, continue to 5. If YES, go to 6.
5.	Project is required to manage hydromodification impacts.			Hydromodification Management Required as described in Section 67.812 b(4) of the WPO.
6.	Project is not required to manage hydromodification impacts.			Hydromodification Exempt. Keep on file.

An exemption is potentially available for projects that are required (No. 5. in Table 2 above) to manage hydromodification impacts: The project proponent may conduct an independent geomorphic study to determine the project's full hydromodification impact. The study must incorporate sediment transport modeling across the range of geomorphically-significant flows and demonstrate to the County's satisfaction that the project flows and sediment reductions will not detrimentally affect the receiving water to qualify for the exemption.

STORMWATER QUALITY DETERMINATION

The following questions provide a guide to collecting information relevant to project stormwater quality issues. Please provide the following information in a printed report accompanying this form.

Table 3

	QUESTIONS	COMPLETED	NA
1.	Describe the topography of the project area.	✔	
2.	Describe the local land use within the project area and adjacent areas.	✔	
3.	Evaluate the presence of dry weather flow.		✔
4.	Determine the receiving waters that may be affected by the project throughout all phases of development (i.e., construction, maintenance and operation).	✔	
5.	For the project limits, list the 303(d) impaired receiving water bodies and their constituents of concern.	✔	
6.	Determine if there are any High Risk Areas (which is defined by the presence of municipal or domestic water supply reservoirs or groundwater percolation facilities) within the project limits.		✔
7.	Determine the Regional Board special requirements, including TMDLs, effluent limits, etc.	✔	
8.	Determine the general climate of the project area. Identify annual rainfall and rainfall intensity curves.	✔	
9.	If considering Treatment BMPs, determine the soil classification, permeability, erodibility, and depth to groundwater.	✔	
10.	Determine contaminated or hazardous soils within the project area.	✔	

TREATMENT BMPs DETERMINATION

Complete the checklist below to determine if Treatment Best Management Practices (BMPs) are required for the project.

Table 4

No.	CRITERIA	YES	NO	INFORMATION
1.	Is this an emergency project		✔	If YES, go to 6. If NO, continue to 2.
2.	Have TMDLs been established for surface waters within the project limit?		✔	If YES, go to 5. If NO, continue to 3.
3.	Will the project directly discharge to a 303(d) impaired receiving water body?		✔	If YES, go to 5. If NO, continue to 4.
4.	Is this project within the environmentally sensitive areas as defined on the maps in Appendix A of the *County of San Diego Standard Urban Storm Water Mitigation Plan for Land Development and Public Improvement Projects*?		✔	If YES, continue to 5. If NO, go to 6.
5.	Provide Treatment BMPs for the project.	✔		If YES, go to 7.
6.	Project is not required to provide Treatment BMPs		✔	Document for Project Files by referencing this checklist.
7.	End			

Now that the need for a treatment BMPs has been determined, other information is required to complete the SWMP.

WATERSHED

Please check the watershed(s) for the project.

☐ San Juan 901	☐ Santa Margarita 902	☐ San Luis Rey 903	☐ Carlsbad 904
☐ San Dieguito 905	☐ Penasquitos 906	☑ San Diego 907	☐ Sweetwater 909
☐ Otay 910	☐ Tijuana 911	☐ Whitewater 719	☐ Clark 720
☐ West Salton 721	☐ Anza Borrego 722	☐ Imperial 723	

Please provide the hydrologic sub-area and number(s)

Number	Name
907.13	El Cajon

Please provide the beneficial uses for Inland Surface Waters and Ground Waters. Beneficial Uses can be obtained from the Water Quality Control Plan for the San Diego Basin, which is available at the Regional Board office or at http://www.swrcb.ca.gov/rwqcb9/programs/basinplan.html.

SURFACE WATERS	Hydrologic Unit Basin Number	MUN	AGR	IND	PROC	GWR	FRESH	POW	REC1	REC2	BIOL	WARM	COLD	WILD	RARE	SPWN
Inland Surface Waters		O		X					X	X		X		X		
Ground Waters		X	X	O	O											

*** Excepted from Municipal**

X Existing Beneficial Use
0 Potential Beneficial Use

POLLUTANTS OF CONCERN

Using Table 5, identify pollutants that are anticipated to be generated from the proposed priority project categories. Pollutants associated with any hazardous material sites that have been remediated or are not threatened by the proposed project are not considered a pollutant of concern.

Table 5. Anticipated and Potential Pollutants Generated by Land Use Type

	General Pollutant Categories								
PDP Categories	Sediments	Nutrients	Heavy Metals	Organic Compounds	Trash & Debris	Oxygen Demanding Substances	Oil & Grease	Bacteria & Viruses	Pesticides
Detached Residential Development	X	X			X	X	X	X	X
Attached Residential Development	X	X			X	P(1)	P(2)	P	X
Commercial Development 1 acre or greater	P(1)	P(1)		P(2)	X	P(5)	X	P(3)	P(5)
Heavy industry /industrial development	X		X	X	X	X	X		
Automotive Repair Shops			X	X(4)(5)	X		X		
Restaurants					X	X	X	X	
Hillside Development >5,000 ft^2	X	X			X	X	X		X
Parking Lots	P(1)	P(1)	X		X	P(1)	X		P(1)
Retail Gasoline Outlets			X	X	X	X	X		
Streets, Highways & Freeways	X	P(1)	X	X(4)	X	P(5)	X		

X = anticipated
P = potential
(1) A potential pollutant if landscaping exists on-site.
(2) A potential pollutant if the project includes uncovered parking areas.
(3) A potential pollutant if land use involves food or animal waste products.
(4) Including petroleum hydrocarbons.
(5) Including solvents.

Note: If other monitoring data that is relevant to the project is available. Please include as Attachment C.

CONSTRUCTION BMPs

Please check the construction BMPs that may be implemented during construction of the project. The applicant will be responsible for the placement and maintenance of the BMPs incorporated into the final project design.

- ☑ Silt Fence
- ☑ Fiber Rolls
- ☑ Street Sweeping and Vacuuming
- ☑ Storm Drain Inlet Protection
- ☑ Stockpile Management
- ☑ Solid Waste Management
- ☑ Stabilized Construction Entrance/Exit
- ☐ Dewatering Operations
- ☑ Vehicle and Equipment Maintenance
- ☑ Desilting Basin
- ☑ Gravel Bag Berm
- ☑ Sandbag Barrier
- ☑ Material Delivery and Storage
- ☑ Spill Prevention and Control
- ☑ Concrete Waste Management
- ☑ Water Conservation Practices
- ☑ Paving and Grinding Operations

- ☑ Any minor slopes created incidental to construction and not subject to a major or minor grading permit shall be protected by covering with plastic or tarp prior to a rain event, and shall have vegetative cover reestablished within 180 days of completion of the slope and prior to final building approval.

EXCEPTIONAL THREAT TO WATER QUALITY DETERMINATION

Complete the checklist below to determine if a proposed project will pose an "exceptional threat to water quality," and therefore require Advanced Treatment Best Management Practices.

Table 6

No.	CRITERIA	YES	NO	INFORMATION
1.	Is all or part of the proposed project site within 200 feet of waters named on the Clean Water Act (CWA) Section 303(d) list of Water Quality Limited Segments as impaired for sedimentation and/or turbidity? Current 303d list may be obtained from the following site: http://www.swrcb.ca.gov/tmdl/docs/303dlists2006/approved/r9_06_303d_reqtmdls.pdf		✔	If YES, continue to 2. If NO, go to 5.
2.	Will the project disturb more than 5 acres, including all phases of the development?		✔	If YES, continue to 3. If NO, go to 5.
3.	Will the project disturb slopes that are steeper than 4:1 (horizontal: vertical) with at least 10 feet of relief, and that drain toward the 303(d) listed receiving water for sedimentation and/or turbidity?		✔	If YES, continue to 4. If NO, go to 5.
4.	Will the project disturb soils with a predominance of USDA-NRCS Erosion factors k_f greater than or equal to 0.4?		✔	If YES, continue to 6. If NO, go to 5.
5.	Project is not required to use Advanced Treatment BMPs.		✔	Document for Project Files by referencing this checklist.
6.	Project poses an "exceptional threat to water quality" and is required to use Advanced Treatment BMPs.		✔	Advanced Treatment BMPs must be consistent with WPO section 67.811(b)(20)(D) performance criteria

Exemption potentially available for projects that require advanced treatment:
Project proponent may perform a Revised Universal Soil Loss Equation, Version 2 (RUSLE 2), Modified Universal Soil Loss Equation (MUSLE), or similar analysis that shows to the County official's satisfaction that advanced treatment is not required

Now that the need for treatment BMPs has been determined, other information is needed to complete the SWMP.

SITE DESIGN

To minimize stormwater impacts, site design measures must be addressed. The following checklist provides options for avoiding or reducing potential impacts during project planning. If YES is checked, it is assumed that the measure was used for this project.

Table 7

	OPTIONS		YES	NO	N/A
1.	Has the project been located and road improvements aligned to avoid or minimize impacts to receiving waters or to increase the preservation of critical (or problematic) areas such as floodplains, steep slopes, wetlands, and areas with erosive or unstable soil conditions?			✔	
2.	Is the project designed to minimize impervious footprint?		✔		
3.	Is the project conserving natural areas where feasible?		✔		
4.	Where landscape is proposed, are rooftops, impervious sidewalks, walkways, trails and patios be drained into adjacent landscaping?		✔		
5.	For roadway projects, are structures and bridges be designed or located to reduce work in live streams and minimize construction impacts?				✔
6.	Can any of the following methods be utilized to minimize erosion from slopes:				
	6.a.	Disturbing existing slopes only when necessary?	✔		
	6.b.	Minimize cut and fill areas to reduce slope lengths?	✔		
	6.c.	Incorporating retaining walls to reduce steepness of slopes or to shorten slopes?	✔		
	6.d.	Providing benches or terraces on high cut and fill slopes to reduce concentration of flows?			✔
	6.e.	Rounding and shaping slopes to reduce concentrated flow?	✔		
	6.f.	Collecting concentrated flows in stabilized drains and channels?	✔		

LOW IMPACT DEVELOPMENT (LID)

Each numbered item below is a LID requirement of the WPO. Please check the box(s) under each number that best describes the Low Impact Development BMP(s) selected for this project.

Table 8

1. Conserve natural Areas, Soils, and Vegetation-County LID Handbook 2.2.1
☑ Preserve well draining soils (Type A or B)
☐ Preserve Significant Trees
☐ Other. Description:
☐ 1. Not feasible. State Reason:
2. Minimize Disturbance to Natural Drainages-County LID Handbook 2.2.2
☑ Set-back development envelope from drainages
Restrict heavy construction equipment access to planned green/open space areas
☐ Other. Description:
☐ 2. Not feasible. State Reason:
3. Minimize and Disconnect Impervious Surfaces (see 5) -County LID Handbook 2.2.3
☑ Clustered Lot Design
☐ Items checked in 5?
☐ Other. Description:
☐ 3. Not feasible. State Reason:
4. Minimize Soil Compaction-County LID Handbook 2.2.4
Restrict heavy construction equipment access to planned green/open space areas
☑ Re-till soils compacted by construction vehicles/equipment
Collect & re-use upper soil layers of development site containing organic materials
☐ Other. Description:
4. Not feasible. State Reason:
5. Drain Runoff from Impervious Surfaces to Pervious Areas-County LID Handbook 2.2.5

LID Street & Road Design
☑ Curb-cuts to landscaping
☐ Rural Swales
☐ Concave Median
☐ Cul-de-sac Landscaping Design
☐ Other. Description:
LID Parking Lot Design
☐ Permeable Pavements
☑ Curb-cuts to landscaping
☐ Other. Description:
LID Driveway, Sidewalk, Bike-path Design
☐ Permeable Pavements
☑ Pitch pavements toward landscaping
☐ Other. Description:
LID Building Design
☑ Cisterns & Rain Barrels
☑ Downspout to swale
☑ Vegetated Roofs
☐ Other. Description:
LID Landscaping Design
☑ Soil Amendments
☑ Reuse of Native Soils
☑ Smart Irrigation Systems
☑ Street Trees
☐ Other. Description:
☐ 5. Not feasible. State Reason:

CHANNELS & DRAINAGES

Complete the following checklist to determine if the project includes work in channels.

Table 9

No.	CRITERIA	YES	NO	N/A	COMMENTS
1.	Will the project include work in channels?		✔		If YES go to 2 If NO go to 13.
2.	Will the project increase velocity or volume of downstream flow?		✔		If YES go to 6.
3.	Will the project discharge to unlined channels?		✔		If YES go to. 6.
4.	Will the project increase potential sediment load of downstream flow?		✔		If YES go to 6.
5.	Will the project encroach, cross, realign, or cause other hydraulic changes to a stream that may affect downstream channel stability?		✔		If YES go to 8.
6.	Review channel lining materials and design for stream bank erosion.		✔		Continue to 7.
7.	Consider channel erosion control measures within the project limits as well as downstream. Consider scour velocity.		✔		Continue to 8.
8.	Include, where appropriate, energy dissipation devices at culverts.			✔	Continue to 9.
9.	Ensure all transitions between culvert outlets/headwalls/wingwalls and channels are smooth to reduce turbulence and scour.	✔			Continue to 10.
10.	Include, if appropriate, detention facilities to reduce peak discharges.	✔			
11.	"Hardening" natural downstream areas to prevent erosion is not an acceptable technique for protecting channel slopes, unless pre-development conditions are determined to be so erosive that hardening would be required even in the absence of the proposed development.		✔		Continue to 12.
12.	Provide other design principles that are comparable and equally effective.	✔			Continue to 13.
13.	End	✔			

SOURCE CONTROL

Please complete the following checklist for Source Control BMPs. If the BMP is not applicable for this project, then check N/A only at the main category.

Table 10

	BMP		YES	NO	N/A
1.	**Provide Storm Drain System Stenciling and Signage**				
	1.a.	All storm drain inlets and catch basins within the project area shall have a stencil or tile placed with prohibitive language (such as: "NO DUMPING – DRAINS TO _____") and/or graphical icons to discourage illegal dumping.	✔		
	1.b.	Signs and prohibitive language and/or graphical icons, which prohibit illegal dumping, must be posted at public access points along channels and creeks within the project area.	✔		
2.	**Design Outdoors Material Storage Areas to Reduce Pollution Introduction**				
	2.a.	This is a detached single-family residential project. Therefore, personal storage areas are exempt from this requirement.	✔		
	2.b.	Hazardous materials with the potential to contaminate urban runoff shall either be: (1) placed in an enclosure such as, but not limited to, a cabinet, shed, or similar structure that prevents contact with runoff or spillage to the storm water conveyance system; or (2) protected by secondary containment structures such as berms, dikes, or curbs.			
	2.c.	The storage area shall be paved and sufficiently impervious to contain leaks and spills.			
	2.d.	The storage area shall have a roof or awning to minimize direct precipitation within the secondary containment area.			
3.	**Design Trash Storage Areas to Reduce Pollution Introduction**				
	3.a.	Paved with an impervious surface, designed not to allow run-on from adjoining areas, screened or walled to prevent off-site transport of trash; or,			
	3.b.	Provide attached lids on all trash containers that exclude rain, or roof or awning to minimize direct precipitation.	✔		
4.	**Use Efficient Irrigation Systems & Landscape Design**				
	The following methods to reduce excessive irrigation runoff shall be considered, and incorporated and implemented where determined applicable and feasible.				
	4.a.	Employing rain shutoff devices to prevent irrigation after precipitation.	✔		
	4.b.	Designing irrigation systems to each landscape area's specific water requirements.	✔		
	4.c.	Using flow reducers or shutoff valves triggered by a pressure drop to control water loss in the event of broken sprinkler heads or lines.	✔		
	4.d.	Employing other comparable, equally effective, methods to reduce irrigation water runoff.	✔		
5.	**Private Roads**				

		BMP	YES	NO	N/A
	The design of private roadway drainage shall use at least one of the following				
	5.a.	Rural swale system: street sheet flows to vegetated swale or gravel shoulder, curbs at street corners, culverts under driveways and street crossings.			✔
	5.b.	Urban curb/swale system: street slopes to curb, periodic swale inlets drain to vegetated swale/biofilter.			✔
	5.c.	Dual drainage system: First flush captured in street catch basins and discharged to adjacent vegetated swale or gravel shoulder, high flows connect directly to storm water conveyance system.	✔		
	5.d.	Other methods that are comparable and equally effective within the project.	✔		
6.	**Residential Driveways & Guest Parking**				
	The design of driveways and private residential parking areas shall use one at least of the following features.				
	6.a.	Design driveways with shared access, flared (single lane at street) or wheelstrips (paving only under tires); or, drain into landscaping prior to discharging to the storm water conveyance system.	✔		
	6.b.	Uncovered temporary or guest parking on private residential lots may be: paved with a permeable surface; or, designed to drain into landscaping prior to discharging to the storm water conveyance system.			✔
	6.c.	Other features which are comparable and equally effective.	✔		
7.	**Dock Areas**				
	Loading/unloading dock areas shall include the following.				
	7.a.	Cover loading dock areas, or design drainage to preclude urban run-on and runoff.			✔
	7.b.	Direct connections to storm drains from depressed loading docks (truck wells) are prohibited.			✔
	7.c.	Other features which are comparable and equally effective.			✔
8.	**Maintenance Bays**				
	Maintenance bays shall include the following.				
	8.a.	Repair/maintenance bays shall be indoors; or, designed to preclude urban run-on and runoff.			✔
	8.b.	Design a repair/maintenance bay drainage system to capture all wash water, leaks and spills. Connect drains to a sump for collection and disposal. Direct connection of the repair/maintenance bays to the storm drain system is prohibited. If required by local jurisdiction, obtain an Industrial Waste Discharge Permit.			✔
	8.c.	Other features which are comparable and equally effective.			✔
9.	**Vehicle Wash Areas**				
	Priority projects that include areas for washing/steam cleaning of vehicles shall use the following.				
	9.a.	Self-contained; or covered with a roof or overhang.			✔
	9.b.	Equipped with a clarifier or other pretreatment facility.			✔
	9.c.	Properly connected to a sanitary sewer.			✔
	9.d.	Other features which are comparable and equally effective.			✔

	BMP		YES	NO	N/A
10.	**Outdoor Processing Areas**				
	Outdoor process equipment operations, such as rock grinding or crushing, painting or coating, grinding or sanding, degreasing or parts cleaning, waste piles, and wastewater and solid waste treatment and disposal, and other operations determined to be a potential threat to water quality by the County shall adhere to the following requirements.				
	10.a.	Cover or enclose areas that would be the most significant source of pollutants; or, slope the area toward a dead-end sump; or, discharge to the sanitary sewer system following appropriate treatment in accordance with conditions established by the applicable sewer agency.			✔
	10.b.	Grade or berm area to prevent run-on from surrounding areas.			✔
	10.c.	Installation of storm drains in areas of equipment repair is prohibited.			✔
	10.d.	Other features which are comparable or equally effective.			✔
11.	**Equipment Wash Areas**				
	Outdoor equipment/accessory washing and steam cleaning activities shall be.				
	11.a.	Be self-contained; or covered with a roof or overhang.			✔
	11.b.	Be equipped with a clarifier, grease trap or other pretreatment facility, as appropriate			✔
	11.c.	Be properly connected to a sanitary sewer.			✔
	11.d.	Other features which are comparable or equally effective.			
12.	**Parking Areas**				
	The following design concepts shall be considered, and incorporated and implemented where determined applicable and feasible by the County.				
	12.a.	Where landscaping is proposed in parking areas, incorporate landscape areas into the drainage design.	✔		
	12.b.	Overflow parking (parking stalls provided in excess of the County's minimum parking requirements) may be constructed with permeable paving.			✔
	12.c.	Other design concepts that are comparable and equally effective.			
13.	**Fueling Area**				
	Non-retail fuel dispensing areas shall contain the following.				
	13.a.	Overhanging roof structure or canopy. The cover's minimum dimensions must be equal to or greater than the area within the grade break. The cover must not drain onto the fuel dispensing area and the downspouts must be routed to prevent drainage across the fueling area. The fueling area shall drain to the project's treatment control BMP(s) prior to discharging to the storm water conveyance system.			✔
	13.b.	Paved with Portland cement concrete (or equivalent smooth impervious surface). The use of asphalt concrete shall be prohibited.			✔
	13.c.	Have an appropriate slope to prevent ponding, and must be separated from the rest of the site by a grade break that prevents run-on of urban runoff.			✔

		BMP	YES	NO	N/A
	13.d.	At a minimum, the concrete fuel dispensing area must extend 6.5 feet (2.0 meters) from the corner of each fuel dispenser, or the length at which the hose and nozzle assembly may be operated plus 1 foot (0.3 meter), whichever is less.			✔

Please list other project specific Source Control BMPs in the following box. Write **N/A** if there are none.

TREATMENT CONTROL

To select a structural treatment BMP using Treatment Control BMP Selection Matrix (Table 11), each priority project shall compare the list of pollutants for which the downstream receiving waters are impaired (if any), with the pollutants anticipated to be generated by the project (as identified in Table 5). Any pollutants identified by Table 5, which are also causing a Clean Water Act section 303(d) impairment of the receiving waters of the project, shall be considered primary pollutants of concern. Priority projects that are anticipated to generate a primary pollutant of concern shall select a single or combination of stormwater BMPs from Table 11, which **maximizes pollutant removal** for the particular primary pollutant(s) of concern.

Priority development projects that are **not** anticipated to generate a pollutant for which the receiving water is CWA 303(d) impaired shall select a single or combination of stormwater BMPs from Table 11, which are effective for pollutant removal of the identified secondary pollutants of concern, consistent with the "maximum extent practicable" standard.

Table 11. Treatment Control BMP Selection Matrix

Pollutants of Concern	Bioretention Facilities (LID)*	Settling Basins (Dry Ponds)	Wet Ponds and Wetlands	Infiltration Facilities or Practices (LID)*	Media Filters	High-rate biofilters	High-rate media filters	Trash Racks & Hydro -dynamic Devices
Coarse Sediment and Trash	High	High	High	High	High	High	High	High
Pollutants that tend to associate with fine particles during treatment	High	High	High	High	High	Medium	Medium	Low
Pollutants that tend to be dissolved following treatment	Medium	Low	Medium	High	Low	Low	Low	Low

*Additional information is available in the County of San Diego LID Handbook.

NOTES ON POLLUTANTS OF CONCERN:
In Table 12, Pollutants of Concern are grouped as gross pollutants, pollutants that tend to associate with fine particles, and pollutants that remain dissolved.

Table 12

Pollutant	Coarse Sediment and Trash	Pollutants that tend to associate with fine particles during treatment	Pollutants that tend to be dissolved following treatment
Sediment	X	X	
Nutrients		X	X
Heavy Metals		X	
Organic Compounds		X	
Trash & Debris	X		
Oxygen Demanding		X	
Bacteria		X	
Oil & Grease		X	
Pesticides		X	

A Treatment BMP must address runoff from developed areas. Please provide the post-construction water quality values for the project. Label outfalls on the BMP map. The Water Quality peak rate of discharge flow (Q_{WQ}) and the Water Quality storage volume (V_{WQ}) is dependent on the type of treatment BMP selected for the project.

Outfall	Tributary Area (acres)	Q_{WQ} (cfs)	V_{WQ} (ft^3)
Per lot	0.16	.011	234.2

Please check the box(s) that best describes the Treatment BMP(s) selected for this project.

Biofilters
☑ Bioretention swale
☑ Vegetated filter strip
☐ Stormwater Planter Box (open-bottomed)
☐ Stormwater Flow-Through Planter (sealed bottom)
☐ Bioretention Area
☐ Vegetated Roofs/Modules/Walls
Detention Basins
☐ Extended/dry detention basin with grass/vegetated lining
☐ Extended/dry detention basin with impervious lining
Infiltration Basins
☐ Infiltration basin
☐ Infiltration trench
☐ Dry well
☐ Permeable Paving
☐ Gravel
☐ Permeable asphalt
☐ Pervious concrete
☐ Unit pavers, ungrouted, set on sand or gravel
☐ Subsurface reservoir bed
Wet Ponds or Wetlands
☐ Wet pond/basin (permanent pool)
☐ Constructed wetland
Filtration
☐ Media filtration
☐ Sand filtration
Hydrodynamic Separator Systems
☐ Swirl Concentrator
☐ Cyclone Separator
Trash Racks and Screens

Include Treatment Datasheet as Attachment E. The datasheet should include the following:	**COMPLETED**	**NO**
1. Description of how treatment BMP was designed. Provide a description for each type of treatment BMP.		
2. Engineering calculations for the BMP(s)		

Please describe why the selected treatment BMP(s) was selected for this project. For projects utilizing a low performing BMP, please provide a detailed explanation.

All landscaped areas, (indicated on Figure 1) and undisturbed natural areas can act as biofilters for irrigation and drainage flow waters. Mulching, seeding and planting of the landscaped areas provide biofiltration of applied pesticides and fertilizers. Following manufacturer guidelines to avoid over treatment of landscaping will provide a limited occurrence of pollutants in the planted areas of the Project. One pervious swale, vegetated biofilters is located along the westerly property line by Pepper Drive. This allows biofiltration and biosettlement of silt and sediments for the street and lots 5,6,7,8,9,10 and 11.Lots 1,2,3 and 4 by Pepper Villa Drive have a Detention Basin for infiltration and cleaning purposes of the water flowing to the street . The swale also allows filtration and some infiltration, due to the characteristics of the soils group B type of soils present on the site, of bacteria and nutrients from the tributary areas. Curb opening allow for the surface drainage flows to enter the swales at designated point. The swale sizing for the tributary areas is per the requirements outlined in the design criteria of "California Storm Water Best Management Practice Handbook, New Development and Redevelopment" by the California Stormwater Quality Association, January 2003. The biofilter swale sizing is shown in Attachment "D" comparing the sizing requirements contained in the handbook vs. the proposed criteria for the pervious swales. See Attachment "D", Permanent BMP Information, for a more detailed sizing calculation. The vegetated swale biofilter then empties into a Type F inlet and finally this cleaned water will sheet flow across Pepper Drive, before joining with the public storm drain system located south of Pepper Drive. The owner of each lot will private maintain the Detention Basin and the Bio swale.

MAINTENANCE

Please check the box that best describes the maintenance mechanism(s) for this project. Guidelines for each category are located in Chapter 5, Section 5.2 of the County SUSMP.

CATEGORY	SELECTED	
	YES	NO
First	✔	
Second[1]		
Third[1]		
Fourth		

Note:

1. Projects in Category 2 or 3 may choose to establish or be included in a Stormwater Maintenance Assessment District for the long-term maintenance of treatment BMPs.

ATTACHMENTS

Please include the following attachments.

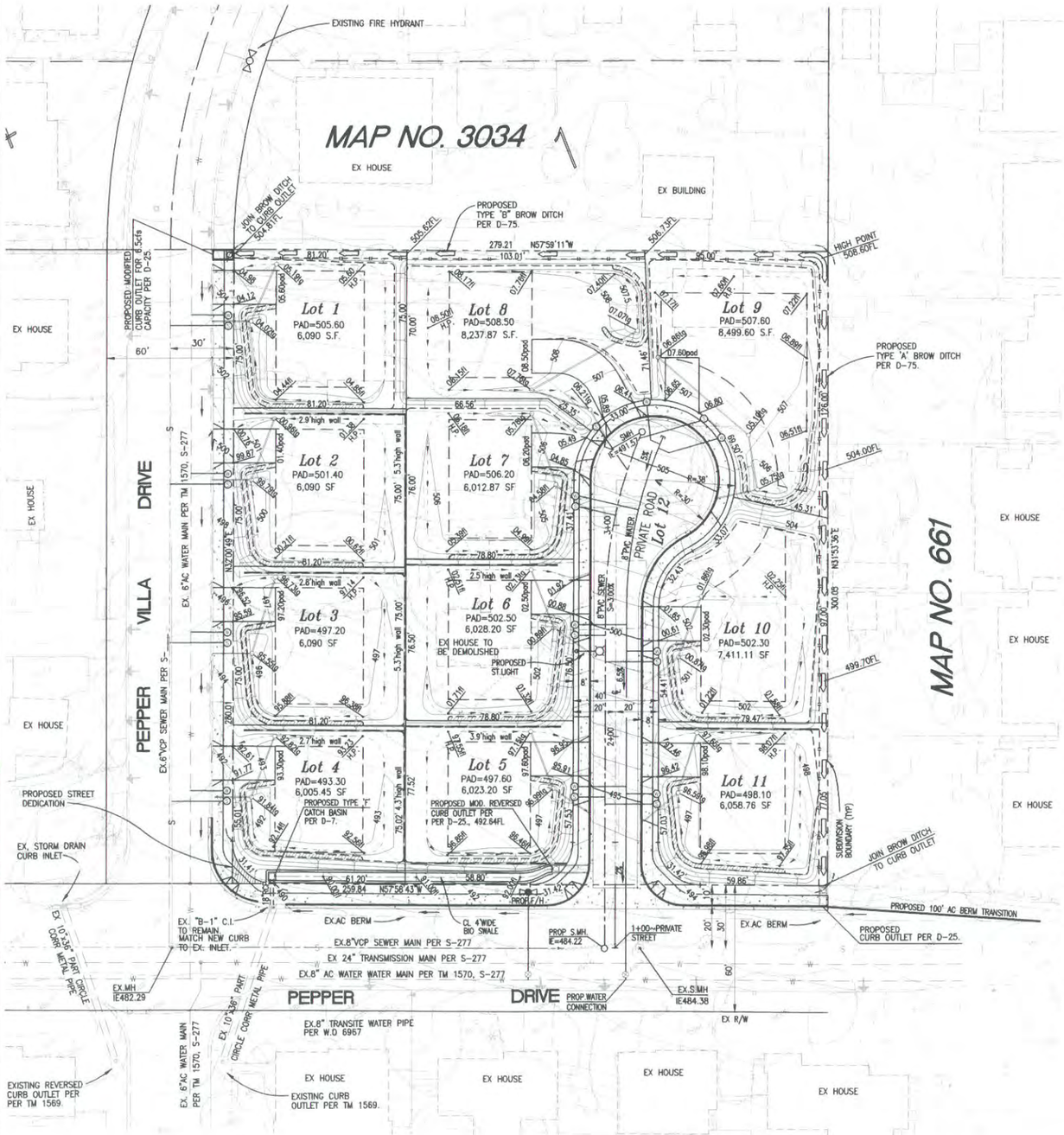
ATTACHMENT		COMPLETED	N/A
A	Project Location Map	✔	
B	Site Map	✔	
C	Relevant Monitoring Data		
D	LID and Treatment BMP Location Map	✔	
E	Treatment BMP Datasheets	✔	
F	Operation and Maintenance Program for Treatment BMPs	✔	
G	Fiscal Resources	✔	
H	Certification Sheet	✔	
I	Addendum		

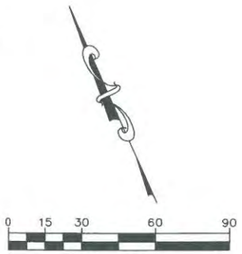
Note: Attachments A and B may be combined.

ATTACHMENT A

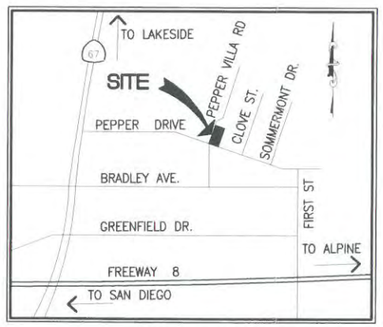
PROJECT LOCATION MAP

COUNTY OF SAN DIEGO TENTATIVE MAP 5517-RPL1



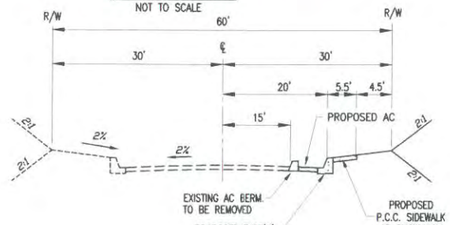


IF PLAN SIZE IS LESS THAN 24"x36", THIS IS A REDUCED COPY. SCALE PLAN ACCORDINGLY.



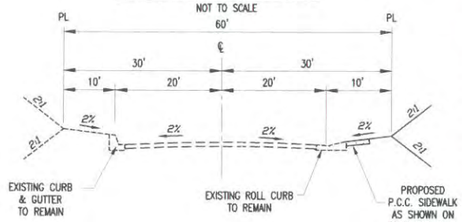
VICINITY MAP

NOT TO SCALE



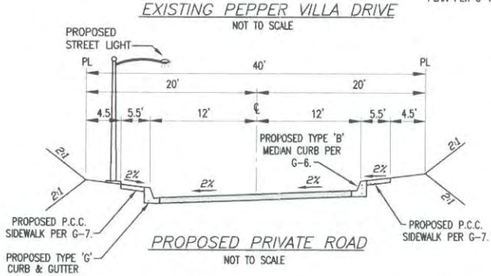
EXISTING PEPPER DRIVE

NOT TO SCALE



EXISTING PEPPER VILLA DRIVE

NOT TO SCALE



PROPOSED PRIVATE ROAD

NOT TO SCALE

OWNER\APPLICANT

RYAN CACY AND SARA CACY
8137 WINTER GARDENS BLVD.
LAKESIDE, CA 92040
(619) 390-2991 PHONE 938-1660 FAX

NOTES:

1. NUMBER OF PROPOSED LOTS: BUILDABLE-11; OPEN SPACE-0
2. INITIATION OF SPECIAL ASSESMENT ACT PROCCEDING IS NOT PROPOSED.
3. PARK FEES TO BE PAID IN LIEU OF PARK LAND DEDICATION.
4. STREET LIGHTING TO BE INSTALLED IN ACCORDANCE WITH COUNTY STANDARDS.

BENCHMARK

DESCRIPTION : G 0281
ELEVATION= 0406.676 M.S.L.

1.0 MI. S SANTEE POST OFF ALONG MAGNOLIA. 100FT N INT AIRPORT DR. AND MAGNOLIA AVE. 27 FT E OF AVE 30 FT N PP 724151H 6.5 FT N OF THE N ONE OF A ROW OF PALM TREES E SIDE HWY STD DISC TOP CONC POST STMPD G 281 1955 ELEV. 406.676

SOURCE OF TOPOGRAPHY:

MORENO AERIAL PHOTO SURVEYS
(PROJECT: MAPS 06-1510 DATED MARCH 29, 2006)

NOTE

"THIS PLAN IS PROVIDED TO ALLOW FOR FULL AND ADEQUATE DISCRETIONARY REVIEW OF A PROPOSED DEVELOPMENT PROJECT. THE PROPERTY OWNER ACKNOWLEDGES THAT ACCEPTANCE OR APPROVAL OF THIS PLAN DOES NOT CONSTITUTE AN APPROVAL TO PERFORM ANY GRADING SHOWN HEREON, AND AGREES TO OBTAIN VALID GRADING PERMISSIONS BEFORE COMMENCING SUCH ACTIVITY."

REFERENCED DRAWINGS

ROAD SURVEY 1344
SEWER S-276, S-277 PADRE DAM

BUILDING SETBACKS

WITH VARIANCE/INCENTIVE, 6000SF (BONUS)

FRONT	40' FROM CENTERLINE
REAR	20' FROM PROPERTY LINE
SIDE	10' FROM PROPERTY LINE
EXTERIOR	35' FROM PROPERTY LINE

TYPICAL SETBACK SHOWN ON PLAN

LOT SIZES

WITH VARIANCE/INCENTIVE, 6000SF (BONUS)

LOT AREA	6,000 SF
LOT DEPTH	78.80'
LOT WIDTH	60'

LOT AREAS

PARCEL	GROSS (AC)	NET (AC)
1	0.140	0.140
2	0.140	0.140
3	0.140	0.140
4	0.138	0.138
5	0.138	0.138
6	0.138	0.138
7	0.138	0.138
8	0.189	0.189
9	0.195	0.195
10	0.170	0.170
11	0.139	0.139
12 (STREET LOT)	0.258	0.258
TOTAL	1.924	1.924

LEGEND

ITEM	SYMBOL
SUBDIVISION BOUNDARY LINE	
LOT LINE	
CUT SLOPE (2:1 MAX.)	
FILL SLOPE (2:1 MAX.)	
PROPOSED 8" PVC WATERMAIN	8" PVC WATER
PROPSED FIRE HYDRANT	F.H.
PROPOSED 8" PVC SEWERMAIN	8" PVC SEWER
PROPOSED SEWER MANHOLE	
PROPOSED SEWER SERVICE	S
PROPOSED WATER SERVICE	W
PROPOSED STREET LIGHT	
PROPOSED CURB OUTLET(D-25)	
PROPOSED STORM DRAIN PIPE	
PROPOSED CURB & GUTTER (G-2)	
PROPOSED SIDEWALK	
PROPOSED YARD DRAIN AND PVC PIPE	
PROPOSED 4' WIDE BIO-SWALE	

LAND DIVISION STATEMENT
OWNER'S CERTIFICATE

I HEREBY CERTIFY THAT I AM THE RECORD OWNER, AS SHOWN ON THE LATEST EQUALIZED COUNTY ASSESSMENT, OF THE PROPERTY SHOWN ON THE TENTATIVE PARCEL MAP. ALL OF MY CONTIGUOUS OWNERSHIP WITHIN AND BEYOND THE BOUNDARIES OF THE TENTATIVE PARCEL MAP ARE SHOWN. THE BASIS OF CREATION OF THE LOTS IN MY OWNERSHIP (E.G., PARCEL MAP, FINAL MAP, CERTIFICATE OF COMPLIANCE, RECORDED DEED BEFORE 2/1/72) IS INDICATED ON THE TENTATIVE MAP. I UNDERSTAND THAT PROPERTY IS CONSIDERED AS CONTIGUOUS EVEN IF IT IS SEPARATED BY ROADS, STREETS, UTILITY EASEMENTS OR RAILROAD RIGHT-OF-WAY. "FREEWAY" AS DEFINED IN SECTION 23.5 OF THE STREETS AND HIGHWAY CODE, SHALL NOT BE CONSIDERED AS ROADS OR STREETS.

I FURTHER CERTIFY THAT I WILL NOT, BY THIS APPLICATION, CREATE OR CAUSE TO BE CREATED, OR WILL NOT HAVE PARTICIPATED IN THE CREATION OF MORE THAN FOUR PARCELS ON CONTIGUOUS PROPERTY UNLESS SUCH CONTIGUOUS PARCELS WERE CREATED BY MAJOR SUBDIVISION. FOR PURPOSES OF THIS CERTIFICATION, THE TERM "PARTICIPATED" MEANS HAVING COOPERATED WITH OR ACTED IN A PLANNING, COORDINATING OR DECISION MAKING CAPACITY IN ANY FORMAL OR INFORMAL ASSOCIATION OR PARTNERSHIP FOR THE PURPOSE OF DIVIDING REAL PROPERTY.

I CERTIFY UNDER PENALTY OF PERJURY THAT THE FOREGOING IS TRUE AND CORRECT.

EXECUTED THIS _____ DAY OF _____, 2007

AT SAN DIEGO, CALIFORNIA.

ABELL FAMILY TRUST

RYAN CACY & SARA CACY
8137 WINTER GARDENS BLVD.
LAKESIDE, CA 92040
(619) 390-2991 PHONE 938-1660 FAX

ASSESSOR'S PARCEL NUMBER: 388-072-03

LEGAL DESCRIPTION:

THAT CERTAIN TRACT OF LAND SITUATED IN THE RANCHO EL CAJON, IN THE COUNTY OF SAN DIEGO, STATE OF CALIFORNIA, BEING A PORTION OF LOTS 7 & 8, ACCORDING TO MAP OF "PORTION OF SOMMERMONT PLACE" AND PORTIONS OF TRACTS 4 AND 5 OF THE "R" TRACT ACCORDING TO PARTITION MAP FILED IN THE SUPERIOR COURT OF SAN DIEGO COUNTY IN ACTION ENTITLED BEN P. HILL ET ALL VS. WILLIAM G. HILL ET ALL, BOUNDED AND DESCRIBED AS FOLLOWS:

BEGINNING AT THE SOUTHWESTERLY COMMON CORNER OF LOTS 6 AND 8 OF PORTION OF SOMMERMONT PLACE, ACCORDING TO MAP THEREOF NO. 661, FILED IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY, APRIL 3, 1891; THENCE NORTHWESTERLY ALONG THE NORTHWESTERLY PROLONGATION OF THE SOUTHWESTERLY LINE OF SAID LOT 6 A DISTANCE OF 280 FEET; THENCE NORTHEASTERLY AT RIGHT ANGLE TO SAID PROLONGATION 300 FEET; THENCE SOUTHEASTERLY AT RIGHT ANGLES 280 FEET TO THE NORTHWESTERLY LINE OF SAID LOT 6; THENCE SOUTHWESTERLY ALONG SAID NORTHWESTERLY LINE 300 FEET TO THE POINT OF BEGINNING.

GENERAL PLAN DESIGNATION:

6

COMMUNITY/SUBREGIONAL

PLAN: PEPPER DRIVE/ BOSTONIA

REGIONAL CATEGORY:

CUDA

PROPOSED USE: RESIDENTIAL

ASSOCIATED PERMITS: RE-ZONING

EXISTING

USE REGULATIONS	RS4
ANIMAL REGS	Q
DENSITY	4.35
LOT SIZE	10,000
BUILDING TYPE	C
MAX FLR AREA	–
FLR AREA RATIO	–
HEIGHT	G
COVERAGE	–
SETBACK	H
OPEN SPACE	–
SPECIAL AREA REGS	–

PROPOSED

USE REGULATIONS	RS4
ANIMAL REGS	Q
DENSITY	7.26
MINIMUM LOT SIZE	6,000
BUILDING TYPE	C
MAX FLR AREA	–
FLR AREA RATIO	–
HEIGHT	G
COVERAGE	–
SETBACK	H
OPEN SPACE	–
SPECIAL AREA REGS	–

PRELIMINARY QUANTITIES:

TOTAL CUT = 340± C.Y. MAX CUT SLOPE RATIO= 2:1
TOTAL FILL = 4,980± C.Y. MAX. FILL SLOPE RATIO=2:1

WATER: HELIX WATER DISTRICT
SEWER: PADRE DAM MUNICIPAL WATER DISTRICT
FIRE: SANTEE FIRE DEPARTMENT
POWER: SAN DIEGO GAS & ELECTRIC
SCHOOL: SANTEE SCHOOL DISTRICT – JUNIOR HIGH
GROSSMONT UNION HIGH SCHOOL DISTRICT

SOLAR ACCESS:

ALL LOTS WITHIN THIS SUBDIVISION HAVE A MINIMUM OF 100 SQUARE FEET OF SOLAR ACCESS FOR EACH FUTURE DWELLING UNIT ALLOWED BY THIS SUBDIVISION.

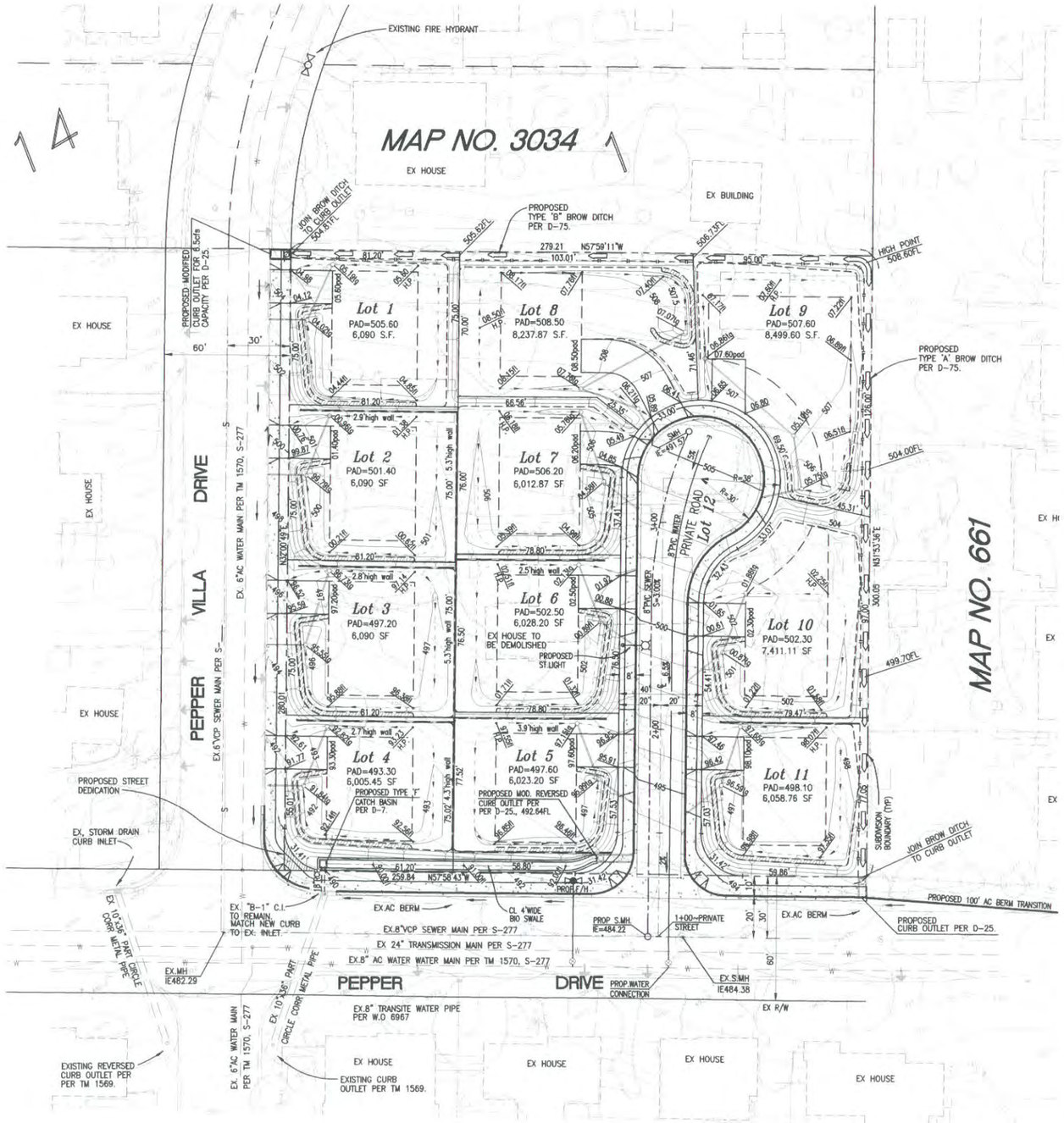
PREPARED BY:

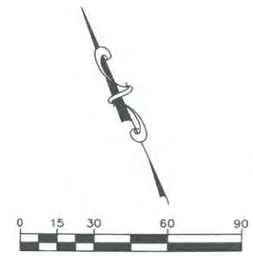
REGISTERED PROFESSIONAL ENGINEER
KAMAL S. SWEIS
No. 48592
EXP. 6/30/10
CIVIL
STATE OF CALIFORNIA

KAMAL SWEIS, RCE 48592 DATE

K&S ENGINEERING
Planning Engineering Surveying
(619)296-5565 7801 Mission Center Court, Suite 100 San Diego Ca 92108

PRELIMINARY GRADING PLAN





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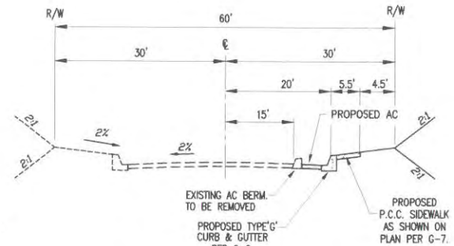
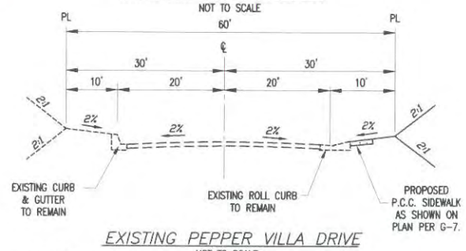
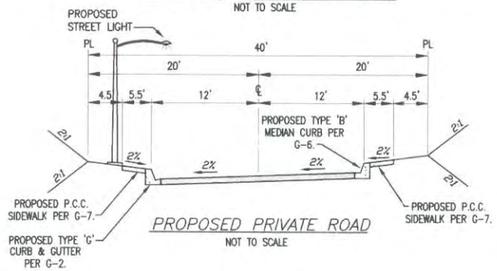


EXISTING PEPPER DRIVE
NOT TO SCALE



EXISTING PEPPER VILLA DRIVE
NOT TO SCALE



PROPOSED PRIVATE ROAD
NOT TO SCALE

OWNER\APPLICANT

RYAN CACY AND SARA CACY
8137 WINTER GARDENS BLVD.
LAKESIDE, CA 92040
(619) 390-2991 PHONE 938-1660 FAX

REFERENCED DRAWINGS

ROAD SURVEY 1344
SEWER S-276, S-277 PADRE DAM

BUILDING SETBACKS

WITH VARIANCE/INCENTIVE, 6000SF (BONUS)

TYPICAL SETBACK SHOWN ON PLAN

FRONT	40' FROM CENTERLINE
REAR	20' FROM PROPERTY LINE
SIDE	10' FROM PROPERTY LINE
EXTERIOR	35' FROM PROPERTY LINE

LOT SIZES

WITH VARIANCE/INCENTIVE, 6000SF (BONUS)

LOT AREA	6,000 SF
LOT DEPTH	78.80'
LOT WIDTH	60'

LOT AREAS

PARCEL	GROSS (AC)	NET (AC)
1	0.140	0.140
2	0.140	0.140
3	0.140	0.140
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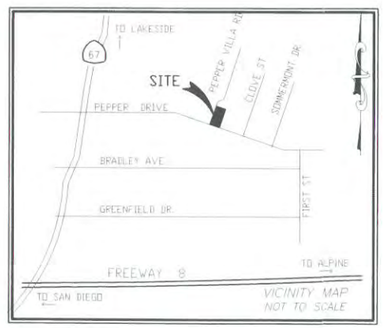
6	0.138	0.138
7	0.138	0.138
8	0.189	0.189
9	0.195	0.195
10	0.170	0.170
11	0.139	0.139
12 (STREET LOT)	0.258	0.258
TOTAL	1.924	1.924



VICINITY MAP
NOT TO SCALE

SHEET 1 OF 1 SHEET

ASSESSOR'S PARCEL NUMBER: 388-072-03

LEGAL DESCRIPTION:

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BEGINNING AT THE SOUTHWESTERLY COMMON CORNER OF LOTS 6 AND 8 OF PORTION OF SOMMERMONT PLACE, ACCORDING TO MAP THEREOF NO. 661, FILED IN THE OFFICE OF THE COUNTY RECORDER OF SAN DIEGO COUNTY, APRIL 3, 1891; THENCE NORTHWESTERLY ALONG THE NORTHWESTERLY PROLONGATION OF THE SOUTHWESTERLY LINE OF SAID LOT 6 A DISTANCE OF 280 FEET; THENCE NORTHEASTERLY AT RIGHT ANGLE TO SAID PROLONGATION 300 FEET; THENCE SOUTHEASTERLY AT RIGHT ANGLES 280 FEET TO THE NORTHWESTERLY LINE OF SAID LOT 6; THENCE SOUTHWESTERLY ALONG SAID NORTHWESTERLY LINE 300 FEET TO THE POINT OF BEGINNING.

GENERAL PLAN DESIGNATION:
6

COMMUNITY/SUBREGIONAL
PLAN: PEPPER DRIVE/ BOSTONIA

REGIONAL CATEGORY:
CUDA

PROPOSED USE: RESIDENTIAL

ASSOCIATED PERMITS: RE-ZONING

SOURCE OF TOPOGRAPHY: MORENO AERIAL PHOTO SURVEYS (PROJECT: MAPS 06-1510 DATED MARCH 29, 2006)

BENCHMARK
DESCRIPTION : G 0281
ELEVATION= 0406.676 M.S.L.

1.0 MI S SANTEE POST OFF ALONG MAGNOLIA, 100FT N INT AIRPORT DR. AND MAGNOLIA AVE. 27 FT E OF AVE 30 FT N PP 724151H 6.5 FT N OF THE N ONE OF A ROW OF PALM TREES E SIDE HWY STD DISC TOP CONC POST STMPD G 281 1955 ELEV. 406.676

PRELIMINARY QUANTITIES:
TOTAL CUT = 340± C.Y. MAX CUT SLOPE RATIO= 2:1
TOTAL FILL = 4,980± C.Y. MAX. FILL SLOPE RATIO=2:1

WATER: HELIX WATER DISTRICT
SEWER: WINTER GARDENS SANITATION DISTRICT
FIRE: SANTEE FIRE DEPARTMENT
POWER: SAN DIEGO GAS & ELECTRIC
SCHOOL: SANTEE SCHOOL DISTRICT – JUNIOR HIGH
GROSSMONT UNION HIGH SCHOOL DISTRICT

SOLAR ACCESS:
ALL LOTS WITHIN THIS SUBDIVISION HAVE A MINIMUM OF 100 SQUARE FEET OF SOLAR ACCESS FOR EACH FUTURE DWELLING UNIT ALLOWED BY THIS SUBDIVISION.

LEGEND

ITEM	SYMBOL
SUBDIVISION BOUNDARY LINE	
LOT LINE	
CUT SLOPE (2:1 MAX.)	
FILL SLOPE (2:1 MAX.)	
PROPOSED 8" PVC WATERMAIN	8" PVC WATER
PROPSED FIRE HYDRANT	F.H.
PROPOSED 8" PVC SEWERMAIN	8" PVC SEWER
PROPOSED SEWER MANHOLE	
PROPOSED SEWER SERVICE	S
PROPOSED WATER SERVICE	W
PROPOSED STREET LIGHT	
PROPOSED CURB OUTLET(D-25)	
PROPOSED STORM DRAIN PIPE	
PROPOSED CURB & GUTTER (G-2)	
PROPOSED SIDEWALK	
PROPOSED YARD DRAIN AND PVC PIPE	
PROPOSED 4' WIDE BIO-SWALE	

NOTE:

"THIS PLAN IS PROVIDED TO ALLOW FOR FULL AND ADEQUATE DISCRETIONARY REVIEW OF A PROPOSED DEVELOPMENT PROJECT. THE PROPERTY OWNER ACKNOWLEDGES THAT ACCEPTANCE OR APPROVAL OF THIS PLAN DOES NOT CONSTITUTE AN APPROVAL TO PERFORM ANY GRADING SHOWN HEREON, AND AGREES TO OBTAIN VALID GRADING PERMISSIONS BEFORE COMMENCING SUCH ACTIVITY."

PREPARED BY:

REGISTERED PROFESSIONAL ENGINEER
KAMAL S. SWEIS
No. 48592
EXP 6/30/08
CIVIL
STATE OF CALIFORNIA

KAMAL SWEIS, RCE 48592

K&S ENGINEERING
Planning Engineering Surveying
(619)296-5565 7888 Mission Center Court, Suite 100 San Diego Ca 92108

ATTACHMENT B

SITE MAP

VICINITY MAP

0 250 500 1000 1500

SCALE: 500'

K&S ENGINEERING
Planning Engineering Surveying
7801 Mission Center Court, Suite 100
San Diego, CA 92108 (619)296-5565

ATTACHMENT C

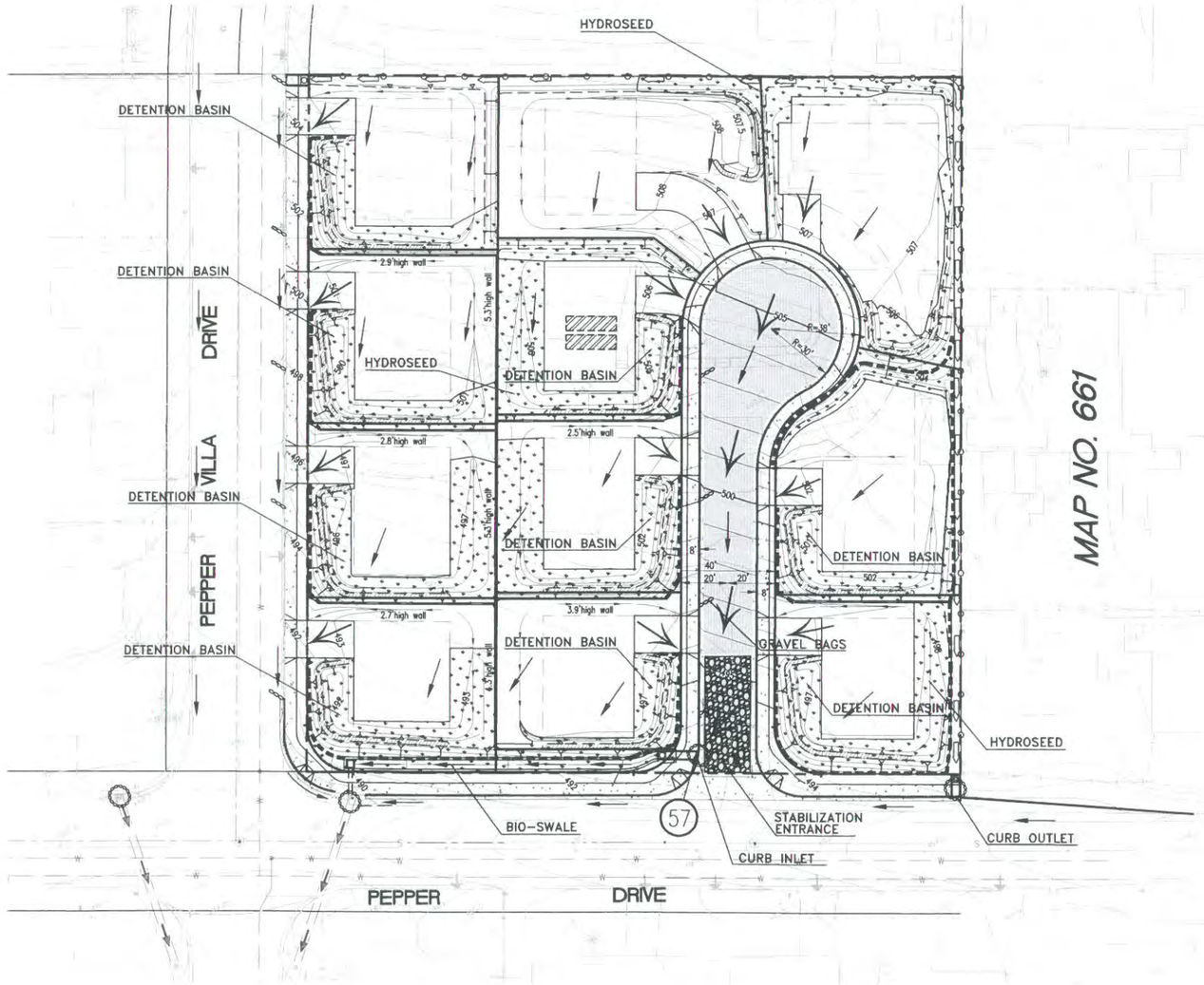
RELEVANT MONITORING DATA

(NOTE: PROVIDE RELEVANT WATER QUALITY MONITORING DATA IF AVAILABLE.)

ATTACHMENT D

LID AND TREATMENT BMP LOCATION MAP

PEPPER VILLA
TM 5517 RPL-1



MAP NO. 661

PROJECT INFORMATION SITE MAP

LEGEND

- DRAINAGE STRUCTURE FLOW
- SURFACE FLOW (EXIST/PROP)
- DRAINAGE AREA
- EXISTING SLOPE
- FIBER ROLL
- BROW DITCH

B.M.P.	CALTRANS CODE	SYMBOL
STABILIZED CONSTRUCTION ENTRANCE	TC-1,3	
SILT FENCE	SC-1	
GRAVEL BAG CHECK DAM BARRIER	SC-4,6,8	
GRAVEL BAG INLET PROTECTION	SC-10	
MATERIAL DELIVERY AND STORAGE/ SOLID WASTE MANAGEMENT	WM-1,5,6,8,9	
VEGETATED SWALE W/FLOW DIRECTION		
PADS STABILIZATION OR BFM		
AREA TO BE HYDROSEEDED WITH BFM		

TRIBUTORY AREAS FOR CACH UNIT			
OUTFALL NODE	ACRE	Q_{100} (CFS)	Q_{10} (CFS)
57	1.34	3.48	0.14

0 15 30 60 90

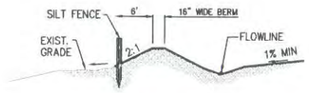
SCALE: 1"=30'

IF PLAN SIZE IS LESS THAN 24"x36", THIS IS A REDUCED COPY. SCALE PLAN ACCORDINGLY.

REGISTERED PROFESSIONAL ENGINEER — KAMAL S. SWETS — No. 48592 EXP. 6/30/10 CIVIL — STATE OF CALIFORNIA

K&S ENGINEERING, INC.
Planning . Engineering . Surveying
06-011
7801 Mission Center Court, Suite 100 San Diego, CA 92108
(619) 296-5565 Fax: (619) 296-5564

VICINITY MAP
NO SCALE



SECTION
NO SCALE

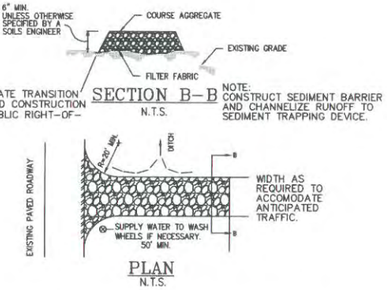
NOTES:

IN THE EVENT THAT THE CLEARED SITE REMAINS EMPTY FOR A PERIOD OF MORE THAN THIRTY DAYS, THE AREA SHALL BE PROTECTED. THAT PROTECTION SHALL BE IN THE FORM OF SOIL STABILIZATION THROUGH THE USE OF:
A SOIL BINDER (COPOLYMER EMULSION BLEND) FOR ANY AREA (INCLUDING 1:1)
STABILIZED FIBER MATRIX (SFM) FOR SLOPED AREAS LESS THAN 2½:1
BONDED FIBER MATRIX (BFM) FOR SLOPED AREAS GREATER THAN 2½:1
OR HYDROSEED (AT THE DISCRETION OF THE CITY ENGINEER).
THE BUILDING PAD AREA WILL UTILIZE FIBER ROLLS TO CONTAIN SEDIMENT.
THE HYDROSEED MIX SPECIFIED (EITHER ON THIS SHEET OR LANDSCAPE PLANS) IS A NATIVE MIX AND WILL REQUIRE NO IRRIGATION AFTER IT HAS BEEN ESTABLISHED. IRRIGATION TO ESTABLISH SEED MIX WILL BE BY WATER TRUCK.

HYDROSEED MIX:

ARTEMESIA CALIFORNIA	(CALIFORNIA SAGEBRUSH)	4 LBS/ACRE
BACCHARIS EMERI	(COYOTE BRUSH)	4 LBS/ACRE
BACCHARIS SAROTHROIDES	(DESERT BROOM)	2 LBS/ACRE
ENCELIS CALIFORNIA	(CALIFORNIA SUNFLOWER)	8 LBS/ACRE
ERIOGONUM FASCICULATUM	(CALIFORNIA BUCKWHEAT)	20 LBS/ACRE
HETEROMELES ARBUTIFOLIA	(TOYON)	5 LBS/ACRE
RHUS LAURINA	(LAUREL SUMAC)	4 LBS/ACRE
SALVIA MELIFERA	(BLACK SAGE)	4 LBS/ACRE

1. SOIL PREPARATION:
   A. WATER ALL PLANTING AREAS THOROUGHLY AND CONTINUOUSLY FOR THREE (3) CONSECUTIVE DAYS TO SATURATE UPPER LAYER OF SOIL PRIOR TO HYDROSEEDING OPERATION.
   B. ALLOW PLANTING AREA SOIL SURFACE TO DRY OUT FOR ONE DAY ONLY PRIOR TO THE HYDROSEEDING APPLICATION. CARE MUST BE TAKEN TO NOT ALLOW THE SOIL SURFACE TO BE SUPER SATURATED WITH WATER PRIOR TO THE HYDROSEEDING INSTALLATION. AT THE SAME TIME THE SOIL SURFACE SHOULD NOT BE BONE DRY. THERE SHOULD BE SOME RESIDUAL MOISTURE WITHIN THE FIRST 1/4 INCH OF SOIL SURFACE.
   C. BEGIN THE HYDROSEEDING OPERATION ON ALL AREAS AS SPECIFIED HEREIN.
2. PREPARATION OF HYDROSEEDING MIXTURE:
   A. THE SLURRY SHALL BE PREPARED AT THE SITE AND ITS COMPONENTS SHALL BE MIXED TO SUPPLY THE RATES OF APPLICATION AS PER SPECIFICATIONS.
   B. SLURRY PREPARATION SHALL BEGIN BY ADDING WATER TO THE LINK WHEN THE ENGINE IS AT ONE-HALF THROTTLE. WHEN THE WATER LEVEL HAS REACHED THE HEIGHT OF THE AGITATOR SHAFT AND GOOD RECIRCULATION HAS BEEN ESTABLISHED, THE FERTILIZER SHALL BE ADDED TO THE MIXTURE (THE TANK SHALL BE AT LEAST 1/3 FILED WITH WATER AT THIS TIME).
   C. THE ENGINE THROTTLE SHALL BE OPEN TO FULL SPEED WHEN THE TANK IS 1/2 FILLED WITH WATER. ALL ORGANIC AMENDMENTS, FIBER, AND CHEMICALS SHALL THEN BE ADDED BY THE TIME THE TANK IS 2-1/3 TO 3/4 FULL. AT THIS TIME THE SEED MIX SHALL ALSO BE ADDED.
   D. SPRAYING SHALL COMMENCE IMMEDIATELY WHEN THE TANK IS FULL AND THE SLURRY IS MIXED.



STABILIZED CONSTRUCTION ENTRANCE TC-1
NO SCALE

NOTES (Cont.):

3. APPLICATION: THE OPERATOR SHALL SPRAY THE AREA WITH A UNIFORM VISIBLE COAT USING THE DARK COLOR OF THE CELLULOSE FIBER OR ORGANIC AMENDMENT AS VISUAL GUIDE. THE SLURRY SHALL BE APPLIED IN A DOWNWARD DRILLING MOTION VIA A FAN STREAM NOZZLE.
4. TIME LIMIT: THE HYDROMULCHING SLURRY COMPONENTS ARE NOT TO BE LEFT IN THE HYDROMULCHING MACHINE FOR MORE THAN TWO HOURS. IF SLURRY COMPONENTS ARE LEFT FOR MORE THAN TWO HOURS IN THE MACHINE, THE CONTRACTOR SHALL ADD 50% MORE OF THE ORIGINALLY SPECIFIED SEED MIX TO ANY SLURRY MIX WHICH HAS NOT BEEN APPLIED WITHIN THE TWO HOURS. AFTER MIXING, THE CONTRACTOR SHALL ADD 75% MORE OF THE ORIGINAL SEED MIX TO ANY SLURRY MIXTURE WHICH HAS NOT BEEN APPLIED EIGHT HOURS AFTER MIXING. ANY MIXTURE NOT APPLIED AFTER EIGHT HOURS SHALL BE REJECTED AND DISPOSED OF OFF-SITE AT CONTRACTOR'S EXPENSE.
5. CLEAN UP:
   AS PROJECT PROGRESSES, CONTRACTOR SHALL MAINTAIN ALL AREAS IN A NEAT MANNER AND REMOVE UNSIGHTLY DEBRIS AS NECESSARY. AFTER COMPLETION OF PROJECT, CONTRACTOR SHALL REMOVE ALL DEBRIS AND CONTAINERS USED IN ACCOMPLISHING WORK. HE SHALL SWEEP AND CLEAN ALL SIDEWALKS, ASPHALT, AND CONCRETE AREAS ADJACENT TO PLANTINGS.

DISTURBED AREA PROTECTION NOTE:

IN THE EVENT THAT THE CLEARED SITE REMAINS EMPTY FOR A PERIOD OF MORE THAN THIRTY DAYS, THE AREA SHALL BE PROTECTED. THAT PROTECTION SHALL BE IN THE FORM OF SOIL STABILIZATION THROUGH THE USE OF:
A SOIL BINDER (COPOLYMER EMULSION BLEND) FOR ANY AREA (INCLUDING 1:1)
STABILIZED FIBER MATRIX (SFM) FOR SLOPED AREAS LESS THAN 2½:1
BONDED FIBER MATRIX (BFM) FOR SLOPED AREAS GREATER THAN 2½:1
GEOTEXTILE, MATS AND EROSION CONTROL BLANKETS FOR ANY SLOPED AREA
OR HYDROSEED (AT THE DISCRETION OF THE CITY ENGINEER).
THE BUILDING PAD AREA WILL UTILIZE FIBER ROLLS TO CONTAIN SEDIMENT.

THE HYDROSEED MIX SPECIFIED (EITHER ON THIS SHEET OR LANDSCAPE PLANS) IS A NATIVE MIX AND WILL REQUIRE NO IRRIGATION AFTER IT HAS BEEN ESTABLISHED. IRRIGATION TO ESTABLISH SEED MIX WILL BE BY WATER TRUCK.

HYDROSEED MIX:

TIME OF INSTALLATION:

IT IS THE INTENT THAT THE HYDROSEED MIX BE APPLIED NO SOONER THAN JUST BEFORE THE FIRST RAIN, IN NOVEMBER, AND NO LATER THAN JUST AFTER THE SECOND RAIN AFTER THE FIRST RAIN IN NOV.

NOTE:

① GRAVEL BAGS IN WORK ZONE ONLY, KEEP CLEAR OF TRAFFIC LANE.

PRIVATE CONTRACT

SHEET		
1	COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS	1 SHEETS

STORM WATER MANAGEMENT PLAN

PEPPER VILLA DRIVE
TM 5517 RPL-1
SANTEE

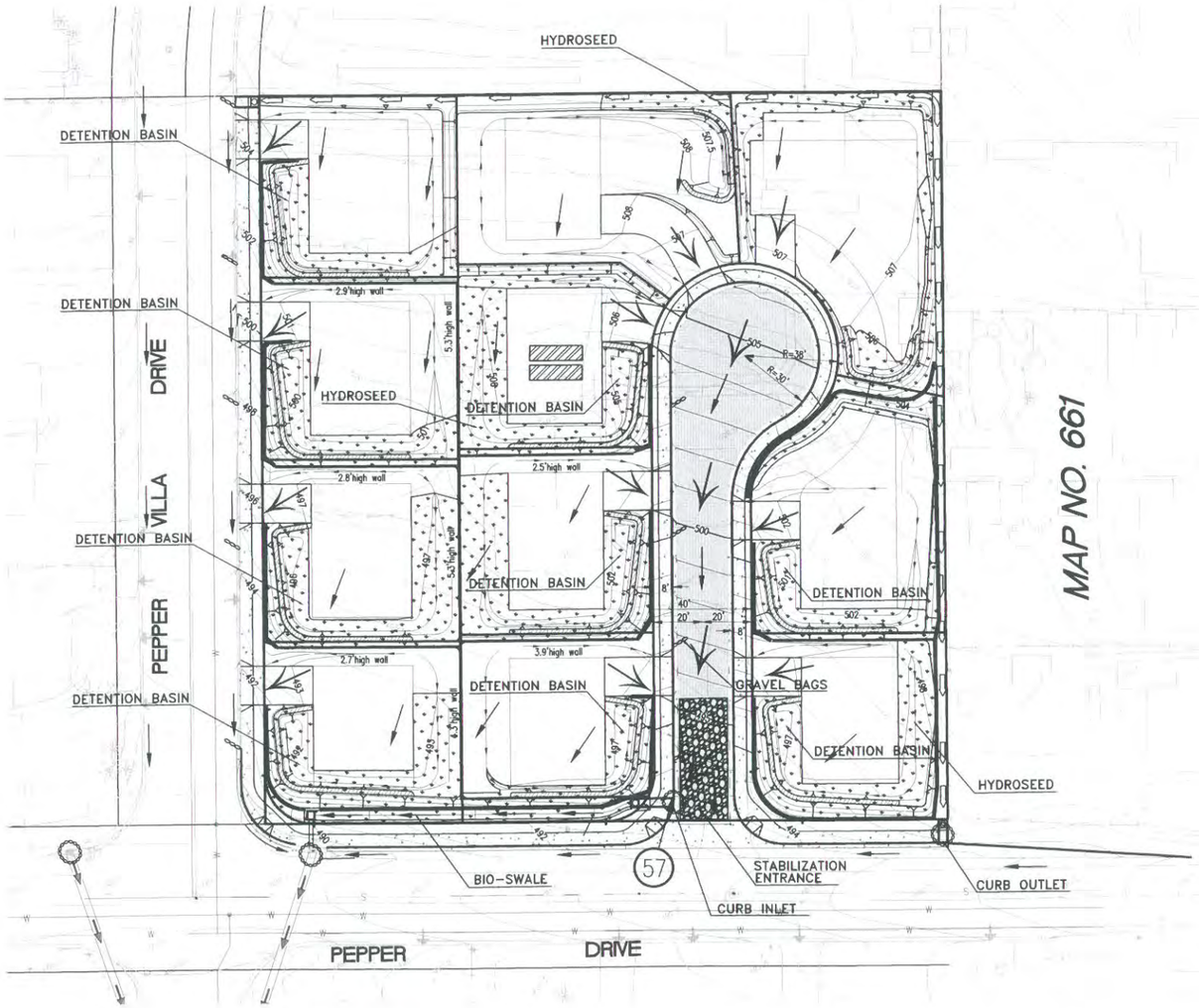
CALIFORNIA COORDINATE INDEX 000-0000

Approved: Douglas M. Isbell
COUNTY ENGINEER
By:
Date

Engineer of work: Kamal S. Swets
R.C.E. 48592

Grading Permit No. —

PEPPER VILLA
TM 5517 RPL-1



MAP NO. 661

DISTURBED AREA PROTECTION NOTE:

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HYDROSEED MIX:

POST-CONSTRUCTION MAINTENANCE PLAN

AT THE COMPLETION OF THE PROJECT, THE FOLLOWING PLAN SHALL BE FOLLOWED TO ENSURE WATER QUALITY CONTROL IS MAINTAINED FOR THE LIFE OF THE PROJECT:

1. STABILIZATION: ALL PLANTED SLOPES AND OTHER VEGETATED AREAS SHALL BE INSPECTED PRIOR TO OCTOBER 1 OF EACH YEAR AND AFTER MAJOR RAINFALL EVENTS (MORE THAN ½ INCH) AND REPAIRED AND REPLANTED AS NEEDED.
2. STRUCTURAL PRACTICES: DESILTING BASINS, DIVERSION DITCHES, DOWNDRAINS, INLETS, OUTLET PROTECTION MEASURES, AND OTHER PERMANENT WATER QUALITY AND SEDIMENT AND EROSION CONTROLS SHALL BE INSPECTED PRIOR TO OCTOBER OF EACH YEAR AND AFTER MAJOR RAINFALL EVENTS (MORE THAN ½ INCH). REPAIRS AND REPLACEMENTS SHALL BE MADE AS NEEDED AND RECORDED IN THE MAINTENANCE LOG.
3. OPERATION AND MAINTENANCE, FUNDING: POST-CONSTRUCTION MANAGEMENT MEASURES ARE THE RESPONSIBILITY OF THE DEVELOPER UNTIL THE TRANSFER OF RESPECTIVE SITES TO THE NEW OWNERS. AT THAT TIME, THE NEW OWNERS SHALL ASSUME RESPONSIBILITY FOR THEIR RESPECTIVE PORTIONS OF THE DEVELOPMENT.

PERMANENT POST-CONSTRUCTION BMP NOTES

1. OPERATION AND MAINTENANCE SHALL BE SECURED BY AN EXECUTED AND RECORDED MAINTENANCE AGREEMENT, COVENANTS CONDITIONS AND RESTRICTIONS (CC&R'S), OR ANOTHER MECHANISM APPROVED THE COUNTY ENGINEER, THAT ASSURES ALL PERMANENT BMP'S WILL BE MAINTAINED PER THE STORM WATER STANDARDS MANUAL.

0 15 30 60 90

SCALE: 1"=30'

IF PLAN SIZE IS LESS THAN 24"x36", THIS IS A REDUCED COPY. SCALE PLAN ACCORDINGLY.

POST CONSTRUCTION BMP SITE MAP

LEGEND

	B.M.P.	CALTRANS CODE	SYMBOL
DRAINAGE STRUCTURE FLOW	VEGETATED SWALE W/FLOW DIRECTION		
SURFACE FLOW (EXIST/PROP)			
DRAINAGE AREA	PADS STABILIZATION OR BFM		
EXISTING SLOPE			
FIBER ROLL			
BROW DITCH			
SILT FENCE			

TIME OF INSTALLATION:

IT IS THE INTENT THAT THE HYDROSEED MIX BE APPLIED NO SOONER THAN JUST BEFORE THE FIRST RAIN, IN NOVEMBER, AND NO LATER THAN JUST AFTER THE SECOND RAIN AFTER THE FIRST RAIN IN NOV.

NOTE:

① GRAVEL BAGS IN WORK ZONE ONLY, KEEP CLEAR OF TRAFFIC LANE.

REGISTERED PROFESSIONAL ENGINEER — KAMAL S. SWEIS — No. 48592 — EXP 6/30/10 — CIVIL — STATE OF CALIFORNIA

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PRIVATE CONTRACT

SHEET 1	COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS	1 SHEETS

STORM WATER MANAGEMENT PLAN

PEPPER VILLA DRIVE
TM 5517 RPL-1
SANTEE

CALIFORNIA COORDINATE INDEX 000-0000

Approved: Douglas M. Isbell COUNTY ENGINEER	Engineer of work: Kamal S. Sweis
By:	R.C.E. 48592
Date	Grading Permit No. —

ATTACHMENT E

TREATMENT BMP DATASHEET

*(**NOTE:** POSSIBLE SOURCE FOR DATASHEETS CAN BE FOUND AT WWW.CABMPHANDBOOKS.COM. INCLUDE ENGINEERING CALCULATIONS FOR SIZING THE TREATMENT BMP.)*

BIO-FILTER SWALE SIZING

PROJECT NAME: PEPPER VILLA
ESCONDIDO, CA

DATE: 7/14/2008

PREPARED BY: K & S ENGINEERING
7801 MISSION CENTER COURT SUITE 100
SAN DIEGO, CA 92108

GIVEN:
C = 0.54
SIDE SLOPES = 2:1 (H:V)
n = 0.25, FOR WQF
I= 0.2 (PER STORMWATER STANDADS)
A= 1.34AC.

RATIONAL EQUATION

Q = C x I x A
WHERE:
Q = PEAK FLOW (FT^3/SEC)
C = RUNOFF COEFFICIENT
I = RAINFALL INTENSITY (IN/HR)
A = TRIBUTARY AREA (ACRES)
FIND: WATER QUALITY FLOW

FIND= 1. Q (WATER QUALITY FLOW)
2. SWALE TREATMENT CAPACITY

TRIBUTARY AREA = 1.34 ACRES

WQF= 0.54 x 0.2 IN/HR x 1.34 ACRES =

W.Q.F.
0.14 C.F.S.

THE PROPOSED SWALE TREATS 0.36 C.F.S.
(SEE MANNING'S CHANNEL CALCULATOR NEXT PAGE)

0.14 C.F.S. < 0.36 C.F.S.(CAPACITY); THEREFORE IS O.K.

THE PROPOSED SWALE HAS THE CAPACITY TO TREAT THE RUN-OFF FROM BASIN

MANNINGS EQUATION

$$Q = \frac{1.49}{0.25} AR^{2/3} S^{1/2}$$

TRAVEL TIME

$$T = d/v$$

$$T = \frac{130ft}{0.19fps} = 684\ s \qquad \frac{x\ 1\ min}{60\ s} = 11.4\ min$$

TIME OF RESIDENCE OF 11.4MIN.>10.0 MIN; THEREFORE IS O.K.

VEGETATED BIO FILTER
Channel Calculator

Given Input Data:

Shape	Trapezoidal
Solving for	Flowrate
Slope	0.0100 ft/ft
Manning's n	0.2500
Depth	4.0000 in
Height	12.0000 in
Bottom width	6.0000 in
Left slope	2.0000 ft/ft (V/H)
Right slope	2.0000 ft/ft (V/H)

Computed Results:

Flowrate	0.0419 cfs
Velocity	0.1884 fps
Full Flowrate	0.3039 cfs
Flow area	0.2222 ft2
Flow perimeter	14.9443 in
Hydraulic radius	2.1413 in
Top width	10.0000 in
Area	1.0000 ft2
Perimeter	32.8328 in
Percent full	33.3333 %

Critical Information

Critical depth	0.7077 in
Critical slope	2.8051 ft/ft
Critical velocity	1.3407 fps
Critical area	0.0312 ft2
Critical perimeter	7.5825 in
Critical hydraulic radius	0.5930 in
Critical top width	6.7077 in
Specific energy	0.3339 ft
Minimum energy	0.0885 ft
Froude number	0.0643
Flow condition	Subcritical

BIO-FILTER SWALE SIZING

PROJECT NAME: PEPPER VILLA
ESCONDIDO, CA

DATE: 7/14/2008

PREPARED BY: K & S ENGINEERING
7801 MISSION CENTER COURT SUITE 100
SAN DIEGO, CA 92108

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C = 0.54
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n = 0.25, FOR WQF
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A= 1.34AC.

RATIONAL EQUATION

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WHERE:

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FIND: WATER QUALITY FLOW

FIND= 1. Q (WATER QUALITY FLOW)
2. SWALE TREATMENT CAPACITY

TRIBUTARY AREA = 1.34 ACRES

WQF= 0.54 x 0.2 IN/HR x 1.34 ACRES =

W.Q.F.
0.14 C.F.S.

THE PROPOSED SWALE TREATS 0.36 C.F.S.
(SEE MANNING'S CHANNEL CALCULATOR NEXT PAGE)

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$$Q = \frac{1.49}{0.25} AR^{2/3} S^{1/2}$$

TRAVEL TIME

$T = d/v$

$$T = \frac{130\text{ft}}{0.19\text{fps}} = 684\text{ s} \qquad \frac{\text{x 1 min}}{60\text{ s}} = 11.4\text{ min}$$

TIME OF RESIDENCE OF 11.4MIN.>10.0 MIN; THEREFORE IS O.K.

85TH PERCENTILE VOLUME CALCULATIONS.

DETERMINE THE VOLUMEN OF RUNOFF FOR VOLUME-BASE BMP'S (V_G) USING THE 85TH PERCENTILE STORM EVENT.

BASIN 1.

$C = 0.54$

$A_T = 1.92$ AC.

$A_1 = A_T / 12$ LOTS.

$A_1 = 6,987$ sf. (0.16 AC).

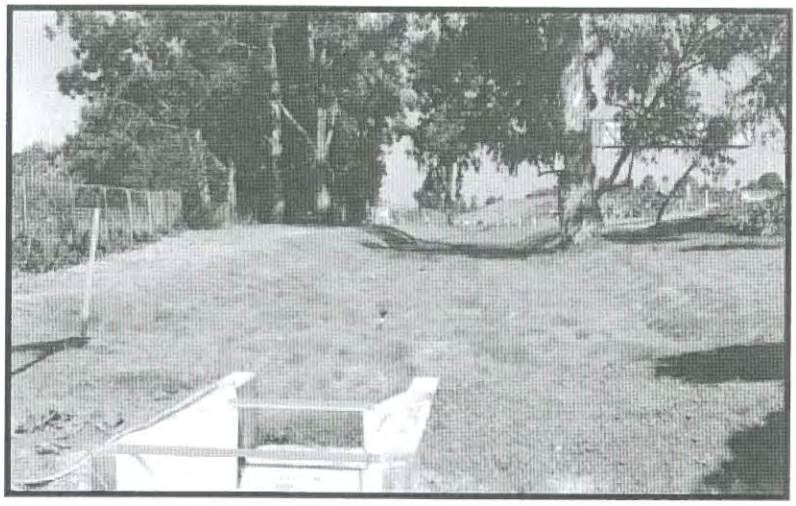
$$V_b = C \times I \times A_1$$

$$= (0.54)(0.75\,IN)(0.16\,AC)\left(1^{FT}/_{12\,IN}\right)(43,560\,FT^2/AC).$$

$$= 234.28\,FT^3$$

$$= 8.67\,CY.$$

Vegetated Swale TC-30



Design Considerations

- Tributary Area
- Area Required
- Slope
- Water Availability

Description

Vegetated swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Vegetated swales can serve as part of a stormwater drainage system and can replace curbs, gutters and storm sewer systems.

Targeted Constituents

☑	Sediment	▲
☑	Nutrients	●
☑	Trash	●
☑	Metals	▲
☑	Bacteria	●
☑	Oil and Grease	▲
☑	Organics	▲

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

California Experience

Caltrans constructed and monitored six vegetated swales in southern California. These swales were generally effective in reducing the volume and mass of pollutants in runoff. Even in the areas where the annual rainfall was only about 10 inches/yr, the vegetation did not require additional irrigation. One factor that strongly affected performance was the presence of large numbers of gophers at most of the sites. The gophers created earthen mounds, destroyed vegetation, and generally reduced the effectiveness of the controls for TSS reduction.

Advantages

- If properly designed, vegetated, and operated, swales can serve as an aesthetic, potentially inexpensive urban development or roadway drainage conveyance measure with significant collateral water quality benefits.

- Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible.

Limitations

- Can be difficult to avoid channelization.
- May not be appropriate for industrial sites or locations where spills may occur
- Grassed swales cannot treat a very large drainage area. Large areas may be divided and treated using multiple swales.
- A thick vegetative cover is needed for these practices to function properly.
- They are impractical in areas with steep topography.
- They are not effective and may even erode when flow velocities are high, if the grass cover is not properly maintained.
- In some places, their use is restricted by law: many local municipalities require curb and gutter systems in residential areas.
- Swales are mores susceptible to failure if not properly maintained than other treatment BMPs.

Design and Sizing Guidelines

- Flow rate based design determined by local requirements or sized so that 85% of the annual runoff volume is discharged at less than the design rainfall intensity.
- Swale should be designed so that the water level does not exceed 2/3rds the height of the grass or 4 inches, which ever is less, at the design treatment rate.
- Longitudinal slopes should not exceed 2.5%
- Trapezoidal channels are normally recommended but other configurations, such as parabolic, can also provide substantial water quality improvement and may be easier to mow than designs with sharp breaks in slope.
- Swales constructed in cut are preferred, or in fill areas that are far enough from an adjacent slope to minimize the potential for gopher damage. Do not use side slopes constructed of fill, which are prone to structural damage by gophers and other burrowing animals.
- A diverse selection of low growing, plants that thrive under the specific site, climatic, and watering conditions should be specified. Vegetation whose growing season corresponds to the wet season are preferred. Drought tolerant vegetation should be considered especially for swales that are not part of a regularly irrigated landscaped area.
- The width of the swale should be determined using Manning's Equation using a value of 0.25 for Manning's n.

Construction/Inspection Considerations

- Include directions in the specifications for use of appropriate fertilizer and soil amendments based on soil properties determined through testing and compared to the needs of the vegetation requirements.
- Install swales at the time of the year when there is a reasonable chance of successful establishment without irrigation; however, it is recognized that rainfall in a given year may not be sufficient and temporary irrigation may be used.
- If sod tiles must be used, they should be placed so that there are no gaps between the tiles; stagger the ends of the tiles to prevent the formation of channels along the swale or strip.
- Use a roller on the sod to ensure that no air pockets form between the sod and the soil.
- Where seeds are used, erosion controls will be necessary to protect seeds for at least 75 days after the first rainfall of the season.

Performance

The literature suggests that vegetated swales represent a practical and potentially effective technique for controlling urban runoff quality. While limited quantitative performance data exists for vegetated swales, it is known that check dams, slight slopes, permeable soils, dense grass cover, increased contact time, and small storm events all contribute to successful pollutant removal by the swale system. Factors decreasing the effectiveness of swales include compacted soils, short runoff contact time, large storm events, frozen ground, short grass heights, steep slopes, and high runoff velocities and discharge rates.

Conventional vegetated swale designs have achieved mixed results in removing particulate pollutants. A study performed by the Nationwide Urban Runoff Program (NURP) monitored three grass swales in the Washington, D.C., area and found no significant improvement in urban runoff quality for the pollutants analyzed. However, the weak performance of these swales was attributed to the high flow velocities in the swales, soil compaction, steep slopes, and short grass height.

Another project in Durham, NC, monitored the performance of a carefully designed artificial swale that received runoff from a commercial parking lot. The project tracked 11 storms and concluded that particulate concentrations of heavy metals (Cu, Pb, Zn, and Cd) were reduced by approximately 50 percent. However, the swale proved largely ineffective for removing soluble nutrients.

The effectiveness of vegetated swales can be enhanced by adding check dams at approximately 17 meter (50 foot) increments along their length (See Figure 1). These dams maximize the retention time within the swale, decrease flow velocities, and promote particulate settling. Finally, the incorporation of vegetated filter strips parallel to the top of the channel banks can help to treat sheet flows entering the swale.

Only 9 studies have been conducted on all grassed channels designed for water quality (Table 1). The data suggest relatively high removal rates for some pollutants, but negative removals for some bacteria, and fair performance for phosphorus.

Table 1 Grassed swale pollutant removal efficiency data							
	Removal Efficiencies (% Removal)						
Study	TSS	TP	TN	NO_3	Metals	Bacteria	Type
Caltrans 2002	77	8	67	66	83-90	-33	dry swales
Goldberg 1993	67.8	4.5	-	31.4	42–62	-100	grassed channel
Seattle Metro and Washington Department of Ecology 1992	60	45	-	-25	2–16	-25	grassed channel
Seattle Metro and Washington Department of Ecology, 1992	83	29	-	-25	46–73	-25	grassed channel
Wang et al., 1981	80	-	-	-	70–80	-	dry swale
Dorman et al., 1989	98	18	-	45	37–81	-	dry swale
Harper, 1988	87	83	84	80	88–90	-	dry swale
Kercher et al., 1983	99	99	99	99	99	-	dry swale
Harper, 1988.	81	17	40	52	37–69	-	wet swale
Koon, 1995	67	39	-	9	-35 to 6	-	wet swale

While it is difficult to distinguish between different designs based on the small amount of available data, grassed channels generally have poorer removal rates than wet and dry swales, although some swales appear to export soluble phosphorus (Harper, 1988; Koon, 1995). It is not clear why swales export bacteria. One explanation is that bacteria thrive in the warm swale soils.

Siting Criteria

The suitability of a swale at a site will depend on land use, size of the area serviced, soil type, slope, imperviousness of the contributing watershed, and dimensions and slope of the swale system (Schueler et al., 1992). In general, swales can be used to serve areas of less than 10 acres, with slopes no greater than 5 %. Use of natural topographic lows is encouraged and natural drainage courses should be regarded as significant local resources to be kept in use (Young et al., 1996).

Selection Criteria (NCTCOG, 1993)

- Comparable performance to wet basins
- Limited to treating a few acres
- Availability of water during dry periods to maintain vegetation
- Sufficient available land area

Research in the Austin area indicates that vegetated controls are effective at removing pollutants even when dormant. Therefore, irrigation is not required to maintain growth during dry periods, but may be necessary only to prevent the vegetation from dying.

The topography of the site should permit the design of a channel with appropriate slope and cross-sectional area. Site topography may also dictate a need for additional structural controls. Recommendations for longitudinal slopes range between 2 and 6 percent. Flatter slopes can be used, if sufficient to provide adequate conveyance. Steep slopes increase flow velocity, decrease detention time, and may require energy dissipating and grade check. Steep slopes also can be managed using a series of check dams to terrace the swale and reduce the slope to within acceptable limits. The use of check dams with swales also promotes infiltration.

Additional Design Guidelines

Most of the design guidelines adopted for swale design specify a minimum hydraulic residence time of 9 minutes. This criterion is based on the results of a single study conducted in Seattle, Washington (Seattle Metro and Washington Department of Ecology, 1992), and is not well supported. Analysis of the data collected in that study indicates that pollutant removal at a residence time of 5 minutes was not significantly different, although there is more variability in that data. Therefore, additional research in the design criteria for swales is needed. Substantial pollutant removal has also been observed for vegetated controls designed solely for conveyance (Barrett et al, 1998); consequently, some flexibility in the design is warranted.

Many design guidelines recommend that grass be frequently mowed to maintain dense coverage near the ground surface. Recent research (Colwell et al., 2000) has shown mowing frequency or grass height has little or no effect on pollutant removal.

Summary of Design Recommendations

1) The swale should have a length that provides a minimum hydraulic residence time of at least 10 minutes. The maximum bottom width should not exceed 10 feet unless a dividing berm is provided. The depth of flow should not exceed 2/3rds the height of the grass at the peak of the water quality design storm intensity. The channel slope should not exceed 2.5%.

2) A design grass height of 6 inches is recommended.

3) Regardless of the recommended detention time, the swale should be not less than 100 feet in length.

4) The width of the swale should be determined using Manning's Equation, at the peak of the design storm, using a Manning's n of 0.25.

5) The swale can be sized as both a treatment facility for the design storm and as a conveyance system to pass the peak hydraulic flows of the 100-year storm if it is located "on-line." The side slopes should be no steeper than 3:1 (H:V).

6) Roadside ditches should be regarded as significant potential swale/buffer strip sites and should be utilized for this purpose whenever possible. If flow is to be introduced through curb cuts, place pavement slightly above the elevation of the vegetated areas. Curb cuts should be at least 12 inches wide to prevent clogging.

7) Swales must be vegetated in order to provide adequate treatment of runoff. It is important to maximize water contact with vegetation and the soil surface. For general purposes, select fine, close-growing, water-resistant grasses. If possible, divert runoff (other than necessary irrigation) during the period of vegetation

establishment. Where runoff diversion is not possible, cover graded and seeded areas with suitable erosion control materials.

Maintenance

The useful life of a vegetated swale system is directly proportional to its maintenance frequency. If properly designed and regularly maintained, vegetated swales can last indefinitely. The maintenance objectives for vegetated swale systems include keeping up the hydraulic and removal efficiency of the channel and maintaining a dense, healthy grass cover.

Maintenance activities should include periodic mowing (with grass never cut shorter than the design flow depth), weed control, watering during drought conditions, reseeding of bare areas, and clearing of debris and blockages. Cuttings should be removed from the channel and disposed in a local composting facility. Accumulated sediment should also be removed manually to avoid concentrated flows in the swale. The application of fertilizers and pesticides should be minimal.

Another aspect of a good maintenance plan is repairing damaged areas within a channel. For example, if the channel develops ruts or holes, it should be repaired utilizing a suitable soil that is properly tamped and seeded. The grass cover should be thick; if it is not, reseed as necessary. Any standing water removed during the maintenance operation must be disposed to a sanitary sewer at an approved discharge location. Residuals (e.g., silt, grass cuttings) must be disposed in accordance with local or State requirements. Maintenance of grassed swales mostly involves maintenance of the grass or wetland plant cover. Typical maintenance activities are summarized below:

- Inspect swales at least twice annually for erosion, damage to vegetation, and sediment and debris accumulation preferably at the end of the wet season to schedule summer maintenance and before major fall runoff to be sure the swale is ready for winter. However, additional inspection after periods of heavy runoff is desirable. The swale should be checked for debris and litter, and areas of sediment accumulation.
- Grass height and mowing frequency may not have a large impact on pollutant removal. Consequently, mowing may only be necessary once or twice a year for safety or aesthetics or to suppress weeds and woody vegetation.
- Trash tends to accumulate in swale areas, particularly along highways. The need for litter removal is determined through periodic inspection, but litter should always be removed prior to mowing.
- Sediment accumulating near culverts and in channels should be removed when it builds up to 75 mm (3 in.) at any spot, or covers vegetation.
- Regularly inspect swales for pools of standing water. Swales can become a nuisance due to mosquito breeding in standing water if obstructions develop (e.g. debris accumulation, invasive vegetation) and/or if proper drainage slopes are not implemented and maintained.

Cost

Construction Cost

Little data is available to estimate the difference in cost between various swale designs. One study (SWRPC, 1991) estimated the construction cost of grassed channels at approximately $0.25 per ft^2. This price does not include design costs or contingencies. Brown and Schueler (1997) estimate these costs at approximately 32 percent of construction costs for most stormwater management practices. For swales, however, these costs would probably be significantly higher since the construction costs are so low compared with other practices. A more realistic estimate would be a total cost of approximately $0.50 per ft^2, which compares favorably with other stormwater management practices.

Table 2 Swale Cost Estimate (SEWRPC, 1991)

Component	Unit	Extent	Unit Cost			Total Cost		
			Low	Moderate	High	Low	Moderate	High
Mobilization / Demobilization-Light	Swale	1	$107	$274	$441	$107	$274	$441
Site Preparation								
Clearing[b]	Acre	0.5	$2,200	$3,800	$5,400	$1,100	$1,900	$2,700
Grubbing[c]	Acre	0.25	$3,800	$5,200	$6,600	$950	$1,300	$1,650
General Excavation[d]	Yd^3	372	$2.10	$3.70	$5.30	$781	$1,376	$1,972
Level and Till[e]	Yd^2	1,210	$0.20	$0.35	$0.50	$242	$424	$605
Sites Development								
Salvaged Topsoil Seed, and Mulch[f]	Yd^2	1,210	$0.40	$1.00	$1.60	$484	$1,210	$1,936
Sod[g]	Yd^2	1,210	$1.20	$2.40	$3.60	$1,452	$2,904	$4,356
Subtotal	--	--	--	--	--	$5,116	$9,388	$13,660
Contingencies	Swale	1	25%	25%	25%	$1,279	$2,347	$3,415
Total	--	--	--	--	--	$6,395	$11,735	$17,075

Source: (SEWRPC, 1991)

Note: Mobilization/demobilization refers to the organization and planning involved in establishing a vegetative swale.

[a] Swale has a bottom width of 1.0 foot, a top width of 10 feet with 1:3 side slopes, and a 1,000-foot length.

[b] Area cleared = (top width + 10 feet) x swale length.

[c] Area grubbed = (top width x swale length).

[d] Volume excavated = (0.67 x top width x swale depth) x swale length (parabolic cross-section).

[e] Area tilled = $\left(\text{top width} + \frac{8(\text{swale depth}^2)}{3(\text{top width})}\right) \times$ swale length (parabolic cross-section).

[f] Area seeded = area cleared x 0.5.

[g] Area sodded = area cleared x 0.5.

Table 3 Estimated Maintenance Costs (SEWRPC, 1991)

Component	Unit Cost	Swale Size (Depth and Top Width)		Comment
		1.5 Foot Depth, One-Foot Bottom Width, 10-Foot Top Width	3-Foot Depth, 3-Foot Bottom Width, 21-Foot Top Width	
Lawn Mowing	$0.85 / 1,000 ft²/ mowing	$0.14 / linear foot	$0.21 / linear foot	Lawn maintenance area=(top width + 10 feet) x length. Mow eight times per year
General Lawn Care	$9.00 / 1,000 ft²/ year	$0.18 / linear foot	$0.28 / linear foot	Lawn maintenance area = (top width + 10 feet) x length
Swale Debris and Litter Removal	$0.10 / linear foot / year	$0.10 / linear foot	$0.10 / linear foot	--
Grass Reseeding with Mulch and Fertilizer	$0.30 / yd²	$0.01 / linear foot	$0.01 / linear foot	Area revegetated equals 1% of lawn maintenance area per year
Program Administration and Swale Inspection	$0.15 / linear foot / year, plus $25 / inspection	$0.15 / linear foot	$0.15 / linear foot	Inspect four times per year
Total	--	$0.58 / linear foot	$ 0.75 / linear foot	--

Maintenance Cost

Caltrans (2002) estimated the expected annual maintenance cost for a swale with a tributary area of approximately 2 ha at approximately $2,700. Since almost all maintenance consists of mowing, the cost is fundamentally a function of the mowing frequency. Unit costs developed by SEWRPC are shown in Table 3. In many cases vegetated channels would be used to convey runoff and would require periodic mowing as well, so there may be little additional cost for the water quality component. Since essentially all the activities are related to vegetation management, no special training is required for maintenance personnel.

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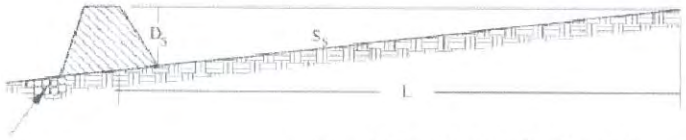
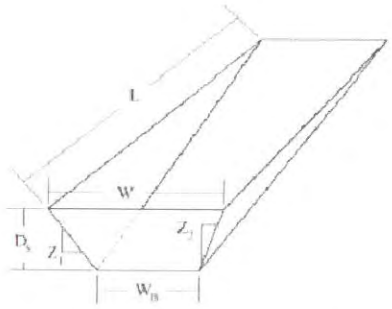


Provide for scour protection.

(a) Cross section of swale with check dam.



(b) Dimensional view of swale impoundment area.

Notation:
L = Length of swale impoundment area per check dam (ft)
D_S = Depth of check dam (ft)
S_S = Bottom slpe of swale (ft/ft)
W = Top width of check dam (ft)
W_B = Bottom width of check dam (ft)
$Z_{1&2}$ = Ratio of horizontal to vertical change in swale side slope (ft/ft)

Bioretention

TC-32

Design Considerations

- Soil for Infiltration
- Tributary Area
- Slope
- Aesthetics
- Environmental Side-effects

Description

The bioretention best management practice (BMP) functions as a soil and plant-based filtration device that removes pollutants through a variety of physical, biological, and chemical treatment processes. These facilities normally consist of a grass buffer strip, sand bed, ponding area, organic layer or mulch layer, planting soil, and plants. The runoff's velocity is reduced by passing over or through buffer strip and subsequently distributed evenly along a ponding area. Exfiltration of the stored water in the bioretention area planting soil into the underlying soils occurs over a period of days.

Targeted Constituents

☑	Sediment	■
☑	Nutrients	▲
☑	Trash	■
☑	Metals	■
☑	Bacteria	■
☑	Oil and Grease	■
☑	Organics	■

Legend *(Removal Effectiveness)*

● Low ■ High

▲ Medium

California Experience

None documented. Bioretention has been used as a stormwater BMP since 1992. In addition to Prince George's County, MD and Alexandria, VA, bioretention has been used successfully at urban and suburban areas in Montgomery County, MD; Baltimore County, MD; Chesterfield County, VA; Prince William County, VA; Smith Mountain Lake State Park, VA; and Cary, NC.

Advantages

- Bioretention provides stormwater treatment that enhances the quality of downstream water bodies by temporarily storing runoff in the BMP and releasing it over a period of four days to the receiving water (EPA, 1999).
- The vegetation provides shade and wind breaks, absorbs noise, and improves an area's landscape.

Limitations

- The bioretention BMP is not recommended for areas with slopes greater than 20% or where mature tree removal would

be required since clogging may result, particularly if the BMP receives runoff with high sediment loads (EPA, 1999).

- Bioretention is not a suitable BMP at locations where the water table is within 6 feet of the ground surface and where the surrounding soil stratum is unstable.
- By design, bioretention BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water.
- In cold climates the soil may freeze, preventing runoff from infiltrating into the planting soil.

Design and Sizing Guidelines

- The bioretention area should be sized to capture the design storm runoff.
- In areas where the native soil permeability is less than 0.5 in/hr an underdrain should be provided.
- Recommended minimum dimensions are 15 feet by 40 feet, although the preferred width is 25 feet. Excavated depth should be 4 feet.
- Area should drain completely within 72 hours.
- Approximately 1 tree or shrub per 50 ft^2 of bioretention area should be included.
- Cover area with about 3 inches of mulch.

Construction/Inspection Considerations

Bioretention area should not be established until contributing watershed is stabilized.

Performance

Bioretention removes stormwater pollutants through physical and biological processes, including adsorption, filtration, plant uptake, microbial activity, decomposition, sedimentation and volatilization (EPA, 1999). Adsorption is the process whereby particulate pollutants attach to soil (e.g., clay) or vegetation surfaces. Adequate contact time between the surface and pollutant must be provided for in the design of the system for this removal process to occur. Thus, the infiltration rate of the soils must not exceed those specified in the design criteria or pollutant removal may decrease. Pollutants removed by adsorption include metals, phosphorus, and hydrocarbons. Filtration occurs as runoff passes through the bioretention area media, such as the sand bed, ground cover, and planting soil.

Common particulates removed from stormwater include particulate organic matter, phosphorus, and suspended solids. Biological processes that occur in wetlands result in pollutant uptake by plants and microorganisms in the soil. Plant growth is sustained by the uptake of nutrients from the soils, with woody plants locking up these nutrients through the seasons. Microbial activity within the soil also contributes to the removal of nitrogen and organic matter. Nitrogen is removed by nitrifying and denitrifying bacteria, while aerobic bacteria are responsible for the decomposition of the organic matter. Microbial processes require oxygen and can result in depleted oxygen levels if the bioretention area is not adequately

aerated. Sedimentation occurs in the swale or ponding area as the velocity slows and solids fall out of suspension.

The removal effectiveness of bioretention has been studied during field and laboratory studies conducted by the University of Maryland (Davis et al, 1998). During these experiments, synthetic stormwater runoff was pumped through several laboratory and field bioretention areas to simulate typical storm events in Prince George's County, MD. Removal rates for heavy metals and nutrients are shown in Table 1.

Table 1 Laboratory and Estimated Bioretention Davis et al. (1998); PGDER (1993)

Pollutant	Removal Rate
Total Phosphorus	70-83%
Metals (Cu, Zn, Pb)	93-98%
TKN	68-80%
Total Suspended Solids	90%
Organics	90%
Bacteria	90%

Results for both the laboratory and field experiments were similar for each of the pollutants analyzed. Doubling or halving the influent pollutant levels had little effect on the effluent pollutants concentrations (Davis et al, 1998).

The microbial activity and plant uptake occurring in the bioretention area will likely result in higher removal rates than those determined for infiltration BMPs.

Siting Criteria

Bioretention BMPs are generally used to treat stormwater from impervious surfaces at commercial, residential, and industrial areas (EPA, 1999). Implementation of bioretention for stormwater management is ideal for median strips, parking lot islands, and swales. Moreover, the runoff in these areas can be designed to either divert directly into the bioretention area or convey into the bioretention area by a curb and gutter collection system.

The best location for bioretention areas is upland from inlets that receive sheet flow from graded areas and at areas that will be excavated (EPA, 1999). In order to maximize treatment effectiveness, the site must be graded in such a way that minimizes erosive conditions as sheet flow is conveyed to the treatment area. Locations where a bioretention area can be readily incorporated into the site plan without further environmental damage are preferred. Furthermore, to effectively minimize sediment loading in the treatment area, bioretention only should be used in stabilized drainage areas.

Additional Design Guidelines

The layout of the bioretention area is determined after site constraints such as location of utilities, underlying soils, existing vegetation, and drainage are considered (EPA, 1999). Sites with loamy sand soils are especially appropriate for bioretention because the excavated soil can be backfilled and used as the planting soil, thus eliminating the cost of importing planting soil.

The use of bioretention may not be feasible given an unstable surrounding soil stratum, soils with clay content greater than 25 percent, a site with slopes greater than 20 percent, and/or a site with mature trees that would be removed during construction of the BMP.

Bioretention can be designed to be off-line or on-line of the existing drainage system (EPA, 1999). The drainage area for a bioretention area should be between 0.1 and 0.4 hectares (0.25 and 1.0 acres). Larger drainage areas may require multiple bioretention areas. Furthermore, the maximum drainage area for a bioretention area is determined by the expected rainfall intensity and runoff rate. Stabilized areas may erode when velocities are greater than 5 feet per second (1.5 meter per second). The designer should determine the potential for erosive conditions at the site.

The size of the bioretention area, which is a function of the drainage area and the runoff generated from the area is sized to capture the water quality volume.

The recommended minimum dimensions of the bioretention area are 15 feet (4.6 meters) wide by 40 feet (12.2 meters) long, where the minimum width allows enough space for a dense, randomly-distributed area of trees and shrubs to become established. Thus replicating a natural forest and creating a microclimate, thereby enabling the bioretention area to tolerate the effects of heat stress, acid rain, runoff pollutants, and insect and disease infestations which landscaped areas in urban settings typically are unable to tolerate. The preferred width is 25 feet (7.6 meters), with a length of twice the width. Essentially, any facilities wider than 20 feet (6.1 meters) should be twice as long as they are wide, which promotes the distribution of flow and decreases the chances of concentrated flow.

In order to provide adequate storage and prevent water from standing for excessive periods of time the ponding depth of the bioretention area should not exceed 6 inches (15 centimeters). Water should not be left to stand for more than 72 hours. A restriction on the type of plants that can be used may be necessary due to some plants' water intolerance. Furthermore, if water is left standing for longer than 72 hours mosquitoes and other insects may start to breed.

The appropriate planting soil should be backfilled into the excavated bioretention area. Planting soils should be sandy loam, loamy sand, or loam texture with a clay content ranging from 10 to 25 percent.

Generally the soil should have infiltration rates greater than 0.5 inches (1.25 centimeters) per hour, which is typical of sandy loams, loamy sands, or loams. The pH of the soil should range between 5.5 and 6.5, where pollutants such as organic nitrogen and phosphorus can be adsorbed by the soil and microbial activity can flourish. Additional requirements for the planting soil include a 1.5 to 3 percent organic content and a maximum 500 ppm concentration of soluble salts.

Soil tests should be performed for every 500 cubic yards (382 cubic meters) of planting soil, with the exception of pH and organic content tests, which are required only once per bioretention area (EPA, 1999). Planting soil should be 4 inches (10.1 centimeters) deeper than the bottom of the largest root ball and 4 feet (1.2 meters) altogether. This depth will provide adequate soil for the plants' root systems to become established, prevent plant damage due to severe wind, and provide adequate moisture capacity. Most sites will require excavation in order to obtain the recommended depth.

Planting soil depths of greater than 4 feet (1.2 meters) may require additional construction practices such as shoring measures (EPA, 1999). Planting soil should be placed in 18 inches or greater lifts and lightly compacted until the desired depth is reached. Since high canopy trees may be destroyed during maintenance the bioretention area should be vegetated to resemble a terrestrial forest community ecosystem that is dominated by understory trees. Three species each of both trees and shrubs are recommended to be planted at a rate of 2500 trees and shrubs per hectare (1000 per acre). For instance, a 15 foot (4.6 meter) by 40 foot (12.2 meter) bioretention area (600 square feet or 55.75 square meters) would require 14 trees and shrubs. The shrub-to-tree ratio should be 2:1 to 3:1.

Trees and shrubs should be planted when conditions are favorable. Vegetation should be watered at the end of each day for fourteen days following its planting. Plant species tolerant of pollutant loads and varying wet and dry conditions should be used in the bioretention area.

The designer should assess aesthetics, site layout, and maintenance requirements when selecting plant species. Adjacent non-native invasive species should be identified and the designer should take measures, such as providing a soil breach to eliminate the threat of these species invading the bioretention area. Regional landscaping manuals should be consulted to ensure that the planting of the bioretention area meets the landscaping requirements established by the local authorities. The designers should evaluate the best placement of vegetation within the bioretention area. Plants should be placed at irregular intervals to replicate a natural forest. Trees should be placed on the perimeter of the area to provide shade and shelter from the wind. Trees and shrubs can be sheltered from damaging flows if they are placed away from the path of the incoming runoff. In cold climates, species that are more tolerant to cold winds, such as evergreens, should be placed in windier areas of the site.

Following placement of the trees and shrubs, the ground cover and/or mulch should be established. Ground cover such as grasses or legumes can be planted at the beginning of the growing season. Mulch should be placed immediately after trees and shrubs are planted. Two to 3 inches (5 to 7.6 cm) of commercially-available fine shredded hardwood mulch or shredded hardwood chips should be applied to the bioretention area to protect from erosion.

Maintenance

The primary maintenance requirement for bioretention areas is that of inspection and repair or replacement of the treatment area's components. Generally, this involves nothing more than the routine periodic maintenance that is required of any landscaped area. Plants that are appropriate for the site, climatic, and watering conditions should be selected for use in the bioretention cell. Appropriately selected plants will aide in reducing fertilizer, pesticide, water, and overall maintenance requirements. Bioretention system components should blend over time through plant and root growth, organic decomposition, and the development of a natural

soil horizon. These biologic and physical processes over time will lengthen the facility's life span and reduce the need for extensive maintenance.

Routine maintenance should include a biannual health evaluation of the trees and shrubs and subsequent removal of any dead or diseased vegetation (EPA, 1999). Diseased vegetation should be treated as needed using preventative and low-toxic measures to the extent possible. BMPs have the potential to create very attractive habitats for mosquitoes and other vectors because of highly organic, often heavily vegetated areas mixed with shallow water. Routine inspections for areas of standing water within the BMP and corrective measures to restore proper infiltration rates are necessary to prevent creating mosquito and other vector habitat. In addition, bioretention BMPs are susceptible to invasion by aggressive plant species such as cattails, which increase the chances of water standing and subsequent vector production if not routinely maintained.

In order to maintain the treatment area's appearance it may be necessary to prune and weed. Furthermore, mulch replacement is suggested when erosion is evident or when the site begins to look unattractive. Specifically, the entire area may require mulch replacement every two to three years, although spot mulching may be sufficient when there are random void areas. Mulch replacement should be done prior to the start of the wet season.

New Jersey's Department of Environmental Protection states in their bioretention systems standards that accumulated sediment and debris removal (especially at the inflow point) will normally be the primary maintenance function. Other potential tasks include replacement of dead vegetation, soil pH regulation, erosion repair at inflow points, mulch replenishment, unclogging the underdrain, and repairing overflow structures. There is also the possibility that the cation exchange capacity of the soils in the cell will be significantly reduced over time. Depending on pollutant loads, soils may need to be replaced within 5-10 years of construction (LID, 2000).

Cost

Construction Cost

Construction cost estimates for a bioretention area are slightly greater than those for the required landscaping for a new development (EPA, 1999). A general rule of thumb (Coffman, 1999) is that residential bioretention areas average about $3 to $4 per square foot, depending on soil conditions and the density and types of plants used. Commercial, industrial and institutional site costs can range between $10 to $40 per square foot, based on the need for control structures, curbing, storm drains and underdrains.

Retrofitting a site typically costs more, averaging $6,500 per bioretention area. The higher costs are attributed to the demolition of existing concrete, asphalt, and existing structures and the replacement of fill material with planting soil. The costs of retrofitting a commercial site in Maryland, Kettering Development, with 15 bioretention areas were estimated at $111,600.

In any bioretention area design, the cost of plants varies substantially and can account for a significant portion of the expenditures. While these cost estimates are slightly greater than those of typical landscaping treatment (due to the increased number of plantings, additional soil excavation, backfill material, use of underdrains etc.), those landscaping expenses that would be required regardless of the bioretention installation should be subtracted when determining the net cost.

Perhaps of most importance, however, the cost savings compared to the use of traditional structural stormwater conveyance systems makes bioretention areas quite attractive financially. For example, the use of bioretention can decrease the cost required for constructing stormwater conveyance systems at a site. A medical office building in Maryland was able to reduce the amount of storm drain pipe that was needed from 800 to 230 feet - a cost savings of $24,000 (PGDER, 1993). And a new residential development spent a total of approximately $100,000 using bioretention cells on each lot instead of nearly $400,000 for the traditional stormwater ponds that were originally planned (Rappahanock,). Also, in residential areas, stormwater management controls become a part of each property owner's landscape, reducing the public burden to maintain large centralized facilities.

Maintenance Cost

The operation and maintenance costs for a bioretention facility will be comparable to those of typical landscaping required for a site. Costs beyond the normal landscaping fees will include the cost for testing the soils and may include costs for a sand bed and planting soil.

References and Sources of Additional Information

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Kim, H., Seagren, E.A., and Davis, A.P., "Engineered Bioretention for Removal of Nitrate from Stormwater Runoff," *WEFTEC 2000 Conference Proceedings on CDROM Research Symposium, Nitrogen Removal*, Session 19, Anaheim CA, October 2000.

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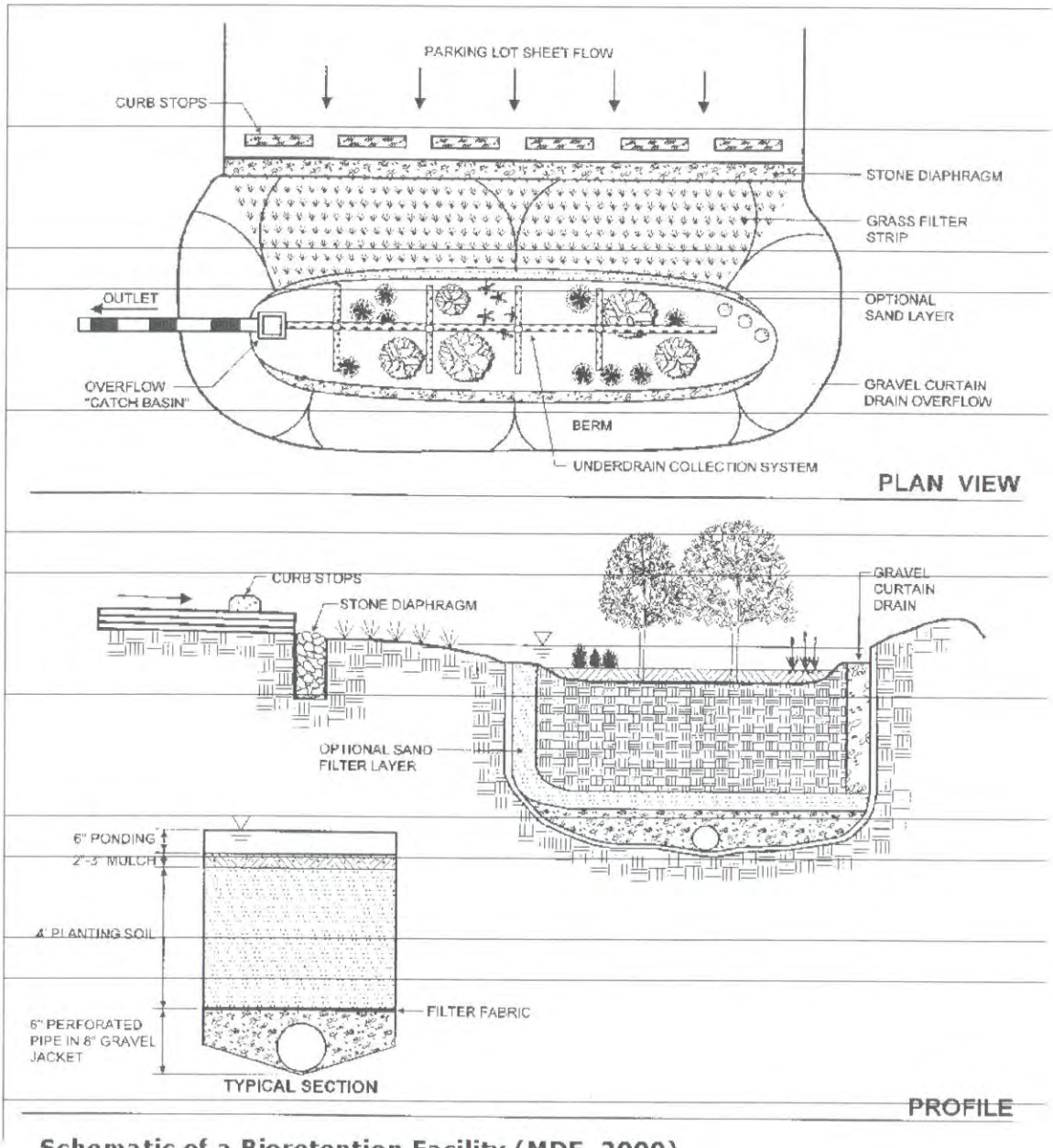
Prince George's County Department of Environmental Resources (PGDER), 1993. Design Manual for Use of *Bioretention in Stormwater Management*. Division of Environmental Management, Watershed Protection Branch. Landover, MD.

U.S. EPA Office of Water, 1999. Stormwater Technology Fact Sheet: Bioretention. EPA 832-F-99-012.

Weinstein, N. Davis, A.P. and Veeramachaneni, R. "Low Impact Development (LID) Stormwater Management Approach for the Control of Diffuse Pollution from Urban Roadways," *5th International Conference Diffuse/Nonpoint Pollution and Watershed Management Proceedings*, C.S. Melching and Emre Alp, Eds. 2001 International Water Association



Schematic of a Bioretention Facility (MDE, 2000)

ATTACHMENT F

OPERATION AND MAINTENANCE PROGRAM FOR TREATMENT BMPS

(NOTE: INFORMATION REGARDING OPERATION AND MAINTENANCE CAN BE OBTAINED FROM THE FOLLOWING WEB SITE:

HTTP://WWW.CO.SAN-DIEGO.CA.US/DPW/WATERSHEDS/LAND_DEV/SUSMP.HTML.)

Permanent BMP Maintenance Program

A schedule of periodic maintenance should be implemented and modified, as needed, to insure effective operation of the indicated permanent site design, source control and treatment BMPs. As a guideline, a tentative schedule of maintenance frequency follows. The schedule is based on certain indicators outlined for a particular BMP.

BMP	ROUTINE ACTIONS	MAINTENANCE INDICATORS	FIELD MEASUREMENT	FREQUENCY	MAINTENANCE ACTIVITY
Porous Swale Vegetated Biofilter and Hydroseeding* * - Hydroseeding only necessary if site not built upon for 30 days after completion or ceasing of grading operations.	Height of vegetation.	Average height of vegetation (grass) exceeds 4".	Visual inspection of vegetation.	Inspect weekly and after rainy periods.	Cut vegetation as required.
	Assess adequate cover.	Bare spots appear in planted/mulched areas or less than 70% coverage over entire area.	Visual inspection of lack of vegetative/mulch cover. Record locations to identify persistent problem areas.	Assess growth on a monthly basis. Assess mulch coverage on a monthly basis.	Reseed vegetated areas as required. No later than November. Scarify area for reseeding. Reapply mulching as required to cover bare spots.
	Inspect for debris accumulation.	Debris or litter accumulation.	Visual inspection for trash.	During routine site landscape maintenance.	Remove and properly dispose of trash, litter and debris.
	Inspect for accumulation of sediment or erosion of soil.	Sediment is at or near vegetation height. Rills or gullies in topsoil.	Visual inspection for sediment depth. Visual inspection for rills and soil erosion.	Inspect monthly and after each significant rainfall.	Remove accumulated sediment when interfering with drainage flows.
Landscaping & Irrigation	Inspect for overgrown plantings.	Grass longer than 2". Bushes and shrubs growing into traveled ways. Trees overhanging and interfering with users of walkways, parking spaces or drive aisles.	Visual observation for indicators when landscaping maintenance performed.	Weekly during growing season. Bi-weekly during winter months.	Cut and trim overgrowth as required.
	Inspect for dead or dieing plants.	Indicators vary as to species, but generally are unhealthy looking growth. Browning, drooping branches and leaves.	Visual observation for indicators.	Weekly during growing season. Bi-weekly during winter months.	Remove and replace dead or dieing plantings.
	Inspect for over irrigation.	Oversaturated ground. Standing water in low spots. Excess run-off of irrigation waters.	Visual observation for indicators.	Weekly during growing season. Bi-weekly during winter months.	Adjust timing mechanism for automatic sprinklers. Increase timing between applications. Consider more frequent, shorter operation periods.
	Inspect for over application of fertilizers or pesticides.	Indicators vary as to materials, but generally are burned spots for excessive fertilizer use and sticky residue or staining for over use of pesticides.	Visual observation for indicators.	Weekly during growing season. Bi-weekly during winter months.	Adjust amounts of materials applied. Consider Integrated Pest Management alternatives.

(Continued)

BMP	ROUTINE ACTIONS	MAINTENANCE INDICATORS	FIELD MEASUREMENT	FREQUENCY	MAINTENANCE ACTIVITY
Integrated Pest Management	Inspect for evidence of undesirable plant species.	Presence of non-native plants or growth, especially in unwanted areas.	Visual observation for indicators.	Seasonally at the minimum. Weekly during growing season.	Remove unwanted species. Replace with native types.
	Inspect for evidence of undesirable insect species.	Presence of non-native or harmful insects. Plant growth destruction.	Visual observation for indicators.	Seasonally at the minimum. Weekly during growing season.	Manage unwanted insects with predatory species or plantings that discourage pest presence. Pesticide use as a last alternative.
	Inspect for evidence of undesirable vertebrate species.	Presence of undesirable animals. Plant growth destruction. Animal scratches on trash dumpsters. Footprints in wet earth, trampled plantings.	Visual observation for indicators. Olfactive presence of animal territory markings.	Weekly during growing season. Seasonally at the minimum.	Manage unwanted animals by eliminating desirable environs. Use of humane traps for relocation. Use poisons as a last alternative.
Storm Drain Signage	Inspect storm drain stencils, signs or placards.	Deteriorating or missing signage.	Visual observation for illegibility or missing signage.	Seasonal observations of signage. More frequently if signage in high traffic areas or subject to adverse conditions.	Repair illegible signage. Replace missing signage.

ATTACHMENT G

FISCAL RESOURCES

FISCAL RESOURCES

The owner/developer of the project will be financially responsible for construction/installation of the post-development BMPs and implementation of the BMPs.

Most of the permanent BMPs accrue minimal maintenance costs. Mulching, seeding and plantings are part of a continuing landscape maintenance program. Landscaping maintenance for permanent stabilization of graded areas will be the responsibility of the owner/developer or a designated association.

Installation and maintenance of the post-development BMPs will be the responsibility of the owner/developer under a BMP Maintenance Agreement. A security will be required to back-up the Maintenance Agreement to equal the cost of two years maintenance activities and the agreement will remain in place for an interim period of five years. The permanent responsibility of the post-development BMPs will remain with the owner/developer or a designated association.

ATTACHMENT H

CERTIFICATION SHEET

This Stormwater Management Plan has been prepared under the direction of the following Registered Civil Engineer. The Registered Civil Engineer attests to the technical information contained herein and the engineering data upon which recommendations, conclusions, and decisions are based.

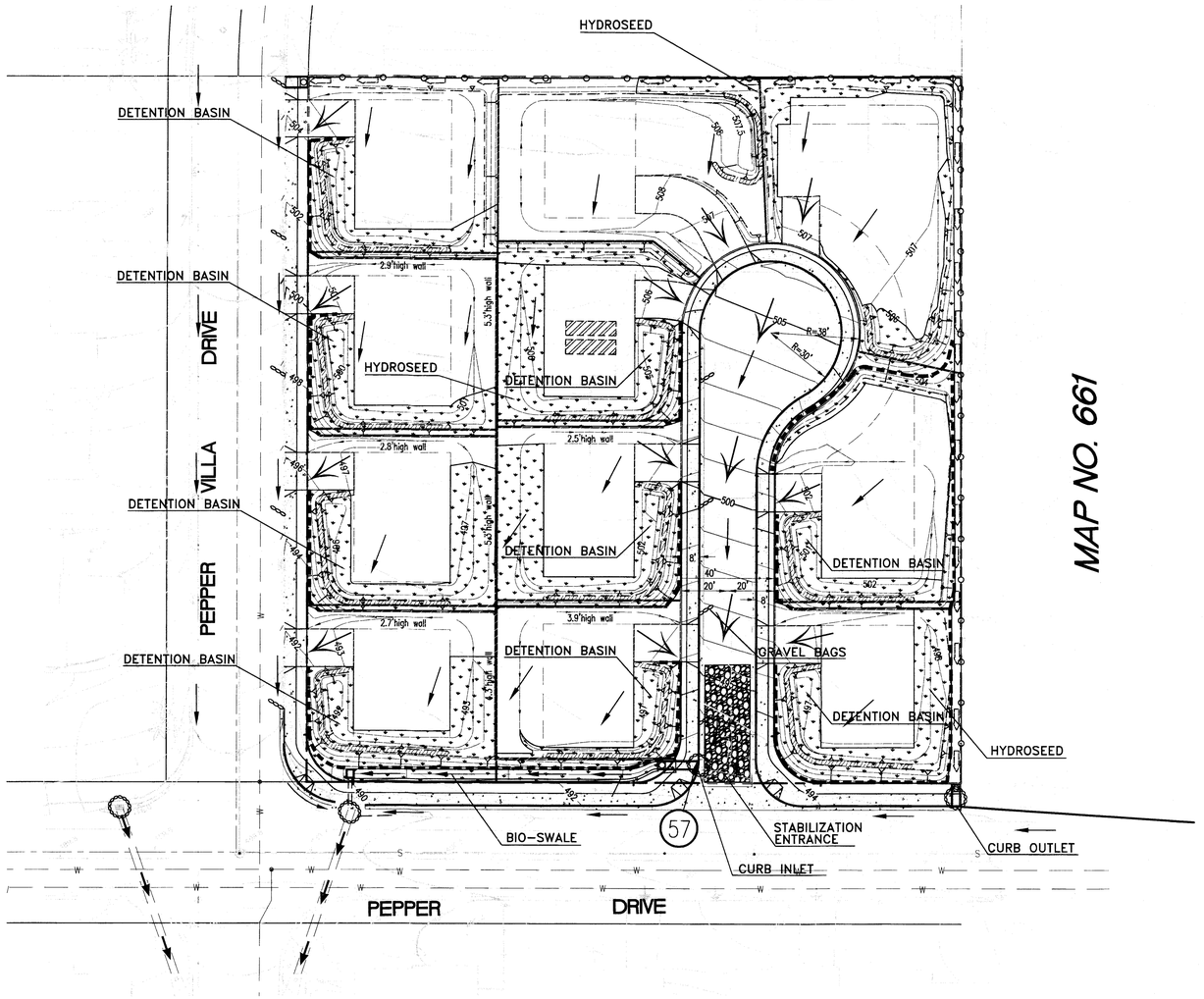
KAMAL S. SWEIS
REGISTERED CIVIL ENGINEER

7-21-08
DATE

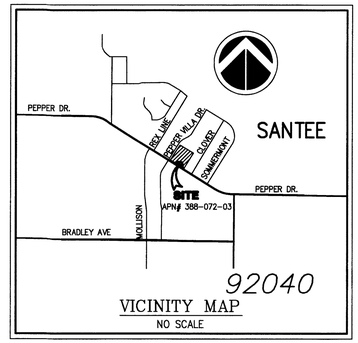
ATTACHMENT I

ADDENDUM

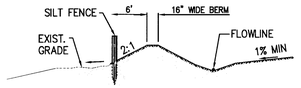
PEPPER VILLA
TM 5517 RPL-1



MAP NO. 661



VICINITY MAP
NO SCALE



SECTION
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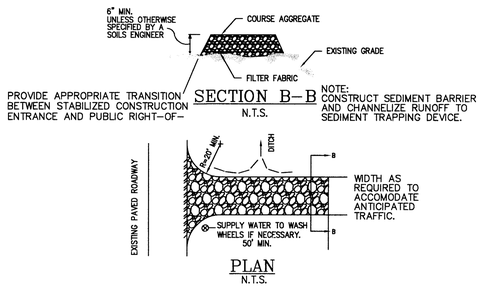

STABILIZED CONSTRUCTION ENTRANCE TC-1
NO SCALE

NOTES:

IN THE EVENT THAT THE CLEARED SITE REMAINS EMPTY FOR A PERIOD OF MORE THAN THIRTY DAYS, THE AREA SHALL BE PROTECTED. THAT PROTECTION SHALL BE IN THE FORM OF SOIL STABILIZATION THROUGH THE USE OF:
A SOIL BINDER (COPOLYMER EMULSION BLEND) FOR ANY AREA (INCLUDING 1:1)
STABILIZED FIBER MATRIX (SFM) FOR SLOPED AREAS LESS THAN 2½:1
BONDED FIBER MATRIX (BFM) FOR SLOPED AREAS GREATER THAN 2½:1
OR HYDROSEED (AT THE DISCRETION OF THE CITY ENGINEER).
THE BUILDING PAD AREA WILL UTILIZE FIBER ROLLS TO CONTAIN SEDIMENT.
THE HYDROSEED MIX SPECIFIED (EITHER ON THIS SHEET OR LANDSCAPE PLANS) IS A NATIVE MIX AND WILL REQUIRE NO IRRIGATION AFTER IT HAS BEEN ESTABLISHED. IRRIGATION TO ESTABLISH SEED MIX WILL BE BY WATER TRUCK.

HYDROSEED MIX:

ARTEMESIA CALIFORNIA	(CALIFORNIA SAGEBRUSH)	4 LBS/ACRE
BACCHARIS EMERI	(COYOTE BRUSH)	4 LBS/ACRE
BACCHARIS SAROTHROIDES	(DESERT BROOM)	2 LBS/ACRE
ENCELIS CALIFORNIA	(CALIFORNIA SUNFLOWER)	8 LBS/ACRE
ERIOGONUM FASCICULATUM	(CALIFORNIA BUCKWHEAT)	20 LBS/ACRE
HETEROMELES ARBUTIFOLIA	(TOYON)	5 LBS/ACRE
RHUS LAURINA	(LAUREL SUMAC)	4 LBS/ACRE
SALVIA MELIFERA	(BLACK SAGE)	4 LBS/ACRE

1. SOIL PREPARATION:
   A. WATER ALL PLANTING AREAS THOROUGHLY AND CONTINUOUSLY FOR THREE (3) CONSECUTIVE DAYS TO SATURATE UPPER LAYER OF SOIL PRIOR TO HYDROSEEDING OPERATION.
   B. ALLOW PLANTING AREA SOIL SURFACE TO DRY OUT FOR ONE DAY ONLY PRIOR TO THE HYDROSEEDING APPLICATION. CARE MUST BE TAKEN TO NOT ALLOW THE SOIL SURFACE TO BE SUPER SATURATED WITH WATER PRIOR TO THE HYDROSEEDING INSTALLATION. AT THE SAME TIME THE SOIL SURFACE SHOULD NOT BE BONE DRY. THERE SHOULD BE SOME RESIDUAL MOISTURE WITHIN THE FIRST 1/4 INCH OF SOIL SURFACE.
   C. BEGIN THE HYDROSEEDING OPERATION ON ALL AREAS AS SPECIFIED HEREIN.
2. PREPARATION OF HYDROSEEDING MIXTURE:
   A. THE SLURRY SHALL BE PREPARED AT THE SITE AND ITS COMPONENTS SHALL BE MIXED TO SUPPLY THE RATES OF APPLICATION AS PER SPECIFICATIONS.
   B. SLURRY PREPARATION SHALL BEGIN BY ADDING WATER TO THE LINK WHEN THE ENGINE IS AT ONE-HALF THROTTLE. WHEN THE WATER LEVEL HAS REACHED THE HEIGHT OF THE AGITATOR SHAFT AND GOOD RECIRCULATION HAS BEEN ESTABLISHED, THE FERTILIZER SHALL BE ADDED TO THE MIXTURE (THE TANK SHALL BE AT LEAST 1/3 FILED WITH WATER AT THIS TIME).
   C. THE ENGINE THROTTLE SHALL BE OPEN TO FULL SPEED WHEN THE TANK IS 1/2 FILLED WITH WATER. ALL ORGANIC AMENDMENTS, FIBER, AND CHEMICALS SHALL THEN BE ADDED BY THE TIME THE TANK IS 2-1/3 TO 3/4 FULL. AT THIS TIME THE SEED MIX SHALL ALSO BE ADDED.
   D. SPRAYING SHALL COMMENCE IMMEDIATELY WHEN THE TANK IS FULL AND THE SLURRY IS MIXED.
3. APPLICATION: THE OPERATOR SHALL SPRAY THE AREA WITH A UNIFORM VISIBLE COAT USING THE DARK COLOR OF THE CELLULOSE FIBER OR ORGANIC AMENDMENT AS VISUAL GUIDE. THE SLURRY SHALL BE APPLIED IN A DOWNWARD DRILLING MOTION VIA A FAN STREAM NOZZLE.
4. TIME LIMIT: THE HYDROMULCHING SLURRY COMPONENTS ARE NOT TO BE LEFT IN THE HYDROMULCHING MACHINE FOR MORE THAN TWO HOURS. IF SLURRY COMPONENTS ARE LEFT FOR MORE THAN TWO HOURS IN THE MACHINE, THE CONTRACTOR SHALL ADD 50% MORE OF THE ORIGINALLY SPECIFIED SEED MIX TO ANY SLURRY MIX WHICH HAS NOT BEEN APPLIED WITHIN THE TWO HOURS AFTER MIXING. THE CONTRACTOR SHALL ADD 75% MORE OF THE ORIGINAL SEED MIX TO ANY SLURRY MIXTURE WHICH HAS NOT BEEN APPLIED EIGHT HOURS AFTER MIXING. ANY MIXTURE NOT APPLIED AFTER EIGHT HOURS SHALL BE REJECTED AND DISPOSED OF OFF-SITE AT CONTRACTOR'S EXPENSE.
5. CLEAN UP:
   AS PROJECT PROGRESSES, CONTRACTOR SHALL MAINTAIN ALL AREAS IN A NEAT MANNER AND REMOVE UNSIGHTLY DEBRIS AS NECESSARY. AFTER COMPLETION OF PROJECT, CONTRACTOR SHALL REMOVE ALL DEBRIS AND CONTAINERS USED IN ACCOMPLISHING WORK. HE SHALL SWEEP AND CLEAN ALL SIDEWALKS, ASPHALT, AND CONCRETE AREAS ADJACENT TO PLANTINGS.

NOTES (Cont.):

DISTURBED AREA PROTECTION NOTE:

IN THE EVENT THAT THE CLEARED SITE REMAINS EMPTY FOR A PERIOD OF MORE THAN THIRTY DAYS, THE AREA SHALL BE PROTECTED. THAT PROTECTION SHALL BE IN THE FORM OF SOIL STABILIZATION THROUGH THE USE OF:
A SOIL BINDER (COPOLYMER EMULSION BLEND) FOR ANY AREA (INCLUDING 1:1)
STABILIZED FIBER MATRIX (SFM) FOR SLOPED AREAS LESS THAN 2½:1
BONDED FIBER MATRIX (BFM) FOR SLOPED AREAS GREATER THAN 2½:1
GEOTEXTILE, MATS AND EROSION CONTROL BLANKETS FOR ANY SLOPED AREA
OR HYDROSEED (AT THE DISCRETION OF THE CITY ENGINEER).
THE BUILDING PAD AREA WILL UTILIZE FIBER ROLLS TO CONTAIN SEDIMENT.

THE HYDROSEED MIX SPECIFIED (EITHER ON THIS SHEET OR LANDSCAPE PLANS) IS A NATIVE MIX AND WILL REQUIRE NO IRRIGATION AFTER IT HAS BEEN ESTABLISHED. IRRIGATION TO ESTABLISH SEED MIX WILL BE BY WATER TRUCK.

HYDROSEED MIX:

TIME OF INSTALLATION:

IT IS THE INTENT THAT THE HYDROSEED MIX BE APPLIED NO SOONER THAN JUST BEFORE THE FIRST RAIN, IN NOVEMBER, AND NO LATER THAN JUST AFTER THE SECOND RAIN AFTER THE FIRST RAIN IN NOV.

NOTE:

① GRAVEL BAGS IN WORK ZONE ONLY, KEEP CLEAR OF TRAFFIC LANE.

PROJECT INFORMATION SITE MAP

LEGEND

- DRAINAGE STRUCTURE FLOW
- SURFACE FLOW (EXIST/PROP)
- DRAINAGE AREA
- EXISTING SLOPE
- FIBER ROLL
- BROW DITCH

B.M.P.	CALTRANS CODE	SYMBOL
STABILIZED CONSTRUCTION ENTRANCE	TC-1,3	
SILT FENCE	SC-1	
GRAVEL BAG CHECK DAM BARRIER	SC-4,6,8	
GRAVEL BAG INLET PROTECTION	SC-10	
MATERIAL DELIVERY AND STORAGE/ SOLID WASTE MANAGEMENT	WM-1,5,6,8,9	
VEGETATED SWALE W/FLOW DIRECTION		
PADS STABILIZATION OR BFM		
AREA TO BE HYDROSEEDED WITH BFM		

TRIBUTORY AREAS FOR CACH UNIT			
OUTFALL NODE	ACRE	Q_{100} (CFS)	Q_{10} (CFS)
57	1.34	3.48	0.14

0 15 30 60 90
SCALE: 1"=30'

IF PLAN SIZE IS LESS THAN 24"x36", THIS IS A REDUCED COPY. SCALE PLAN ACCORDINGLY.

REGISTERED PROFESSIONAL ENGINEER
KAMAL S. SWEIS
No. 48592
EXP 6/30/10
CIVIL
STATE OF CALIFORNIA

K&S ENGINEERING, INC.
Planning . Engineering . Surveying
06-011
7801 Mission Center Court, Suite 100 San Diego, CA 92108
(619) 296-5565 Fax: (619) 296-5564

PRIVATE CONTRACT

SHEET 1	COUNTY OF SAN DIEGO DEPARTMENT OF PUBLIC WORKS	1 SHEETS

STORM WATER MANAGEMENT PLAN

PEPPER VILLA DRIVE
TM 5517 RPL-1
SANTEE

CALIFORNIA COORDINATE INDEX 000-0000

Approved: Douglas M. Isbell
COUNTY ENGINEER
By:
Date

Engineer of work: Kamal S. Sweis
R.C.E. 48592

Grading Permit No. —